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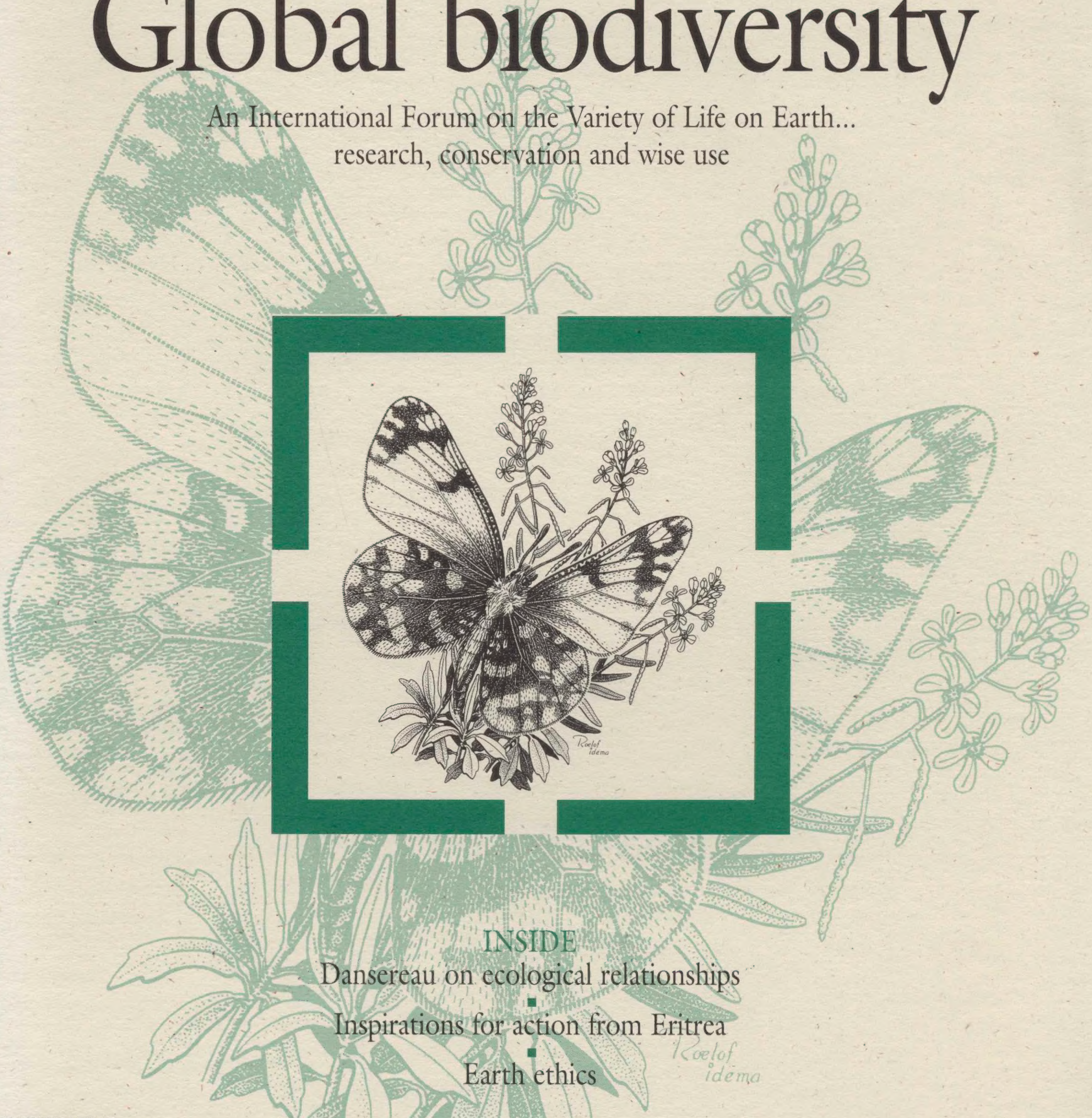

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Editor's Notebook

BIOPIRACY AND GENETIC FINGERPRINTING

One of the cornerstones of the International Convention on Biological Diversity is the fair and equitable sharing of benefits, based on the premise that developed countries and corporations will acknowledge the country of origin for genetic resources they have developed and share the resulting benefits. However, a small proportion of corporations may wish to evade this provision of the Convention, avoiding their societal responsibilities in search of short-term profit. Such biodiversity piracy has a long history and it cannot be expected to end, even with the new international legal instrument in place. Some may wish to smuggle out genetic resources from the country of origin, or acquire the resources by some other illegal pathway or a legal one that evades the spirit of the Convention. Not only would this mean that benefits were not shared, but that the South would not have an incentive, as is intended by the Convention, to conserve the genetic- and species-level components of natural (or agricultural) ecosystems. Unless new resources can be found, the shortage of fiscal and human resources in many developing countries means that biodiversity will continue to be eroded. This is to the long-term disadvantage of both North and South.

Good news! There is a scientific tool that can help detect and hence deter biodiversity piracy. It is called genetic fingerprinting. Taxa, such as species, geographic varieties, and populations, are characterized by the presence of differing genes or gene frequencies. Some of the methods of detecting genetic differences include protein marker and DNA-based techniques. Such methods can identify, in many cases, the geographic area where the specimen originated. There are some drawbacks: the provenance of other specimens may be difficult or impossible to assign, or the process for some may be costly. Those corporations or countries that wish to have open access to genetic resources without obligations will argue that the techniques do not allow sufficient assurance to settle place of origin. Those countries at risk, however, will do well to investigate the power of genetic fingerprinting as a tool to detect or deter biopiracy, and legislate correspondingly.

For more information on this topic, the reader can consult the second appendix in FAO Publication CPGR-Ex1/94/5 Supp. September 1994, Item 3.2 of the Provisional Agenda, Commission on Plant Genetic Resources, First Extraordinary Session, Rome, as well as genetic text books. Although the Article deals with plant genetic resources, most of the principles apply to animal and microbial genetic resources.

Don E. McAllister

Don E McAllister
Editor

Please join the debate
I encourage readers, with access to the Internet, to read my article entitled "The Looming Threat to the Sharing of Benefits," now posted on the Canadian Museum of Nature web site <http://www.nature.ca/english/gbfor.htm>. Then let me know what you think. Please, join the debate! Some of your comments will be published, in conjunction with my article, in the Summer 1997 issue. After mid-April, watch for my perspective on ecoforestry. [D.E.M.].

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The goals of Global biodiversity are to:

- *Publish articles, views, and news on biodiversity*
- *Bridge the gaps between professional disciplines & the public*
- *Communicate vital information to help humankind make decisions on the fate of the Earth's life*
- *Express views on the needs & value of biodiversity research*
- *Provide an international forum for discussing issues on biodiversity*
- *Enhance awareness of the role of biosystematic research & museum collections to conservation & ecologically sustainable use of biodiversity*
- *Discuss methods and philosophy of biodiversity conservation*
- *Review books and periodicals on biodiversity*

IUCN
The World Conservation Union
MEMBER

Global biodiversity

Volume 6, Number 4, Spring 1997

Euchloe ausonides ssp. is an undescribed, almost certainly extinct, subspecies of the Large Marble butterfly species. For more on endangered species, see page 20.

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THE LAST WORD

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Biodiversity, ecodiversity, sociodiversity — Three aspects of diversity: Part 1

Pierre Dansereau

We are pleased to have this three-part contribution from Professor Dansereau for the breadth of view it provides as well as its new insights. Part 1 focuses on the fundamental concept of biological diversity — what governs the diversification of species and how this affects our understanding of biodiversity. In Part 2 (to be published in Summer 1997), the author broadens his discussion by providing insights into "ecodiversity." Finally, in Part 3 (to be published in Fall 1997), Prof. Dansereau explores new insights in a discussion of "sociodiversity." Throughout his paper, Prof. Dansereau provides examples to make his concepts clear and meaningful. Those interested in Prof. Dansereau's illustrious career should turn to page 48. [D.E.M.]

INTRODUCTION

It is not my purpose to undertake a review of the numerous publications on diversity. Neither shall I engage in a defense of biodiversity or demonstration of its value, nor an endorsement of preservation methods. The concept has served as a rallying point for several generations of biologists eager to ensure the survival of threatened species throughout the world. Indeed, urged by the IUCN — the World Conservation Union, Canada (Burnett *et al.* 1989) and Quebec (Bouchard *et al.* 1988) have compiled inventories and formulated prescriptions to protect species, according to the gravity of the threat and the vulnerability of the taxon. Biodiversity is often thought of in terms of the number of species (or taxa) encountered in a given area. But there is much more at stake than biological diversity and my aim here is to broaden the scope of current discussions on "biodiversity" to include "ecodiversity" and "sociodiversity."

Portugeuse-speaking readers, in particular, will be interested to note that an earlier version of this text ("Biodiversidade—ecodiversidade—socio-diversidade") was published in Portuguese in the "Anais do 2° Congresso Nacional sobre Essencias Nativas" (Conservação da Biodiversidade), março-abril 1992, São Paulo: *Revista do Instituto Florestal*, 4 (ed. esp. Parte 1), pp. 22–28. The text has since been adapted and modified for this audience.

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Areas from the wet tropical forest to colder and drier regions run the classic gamut of "richness." In the vast expanses of the Mauritanian desert and the Antarctic continent, only four vascular plant species have been recorded. These areas lack the "richness" of species found, for example, in the Amazon rainforest. This concept of counting species within a certain area has also been applied to much smaller areas within a bioclimatic or even regional zone. In a few earlier publications (1952, 1964, 1971b), I attempted to break out of this framework by replacing concepts of diversity that are based on taxonomic "counts" with discussions about the dimensions of each species' genetic, ecological, and sociological systems.

The very problematic concept of biodiversity is in need of review and revision. In 1997, it seems to me that *continuity* is more threatened than ever. And yet, the current acknowledgement of complexity desperately requires continuity. This must not be seen as looking backwards, but as a recognition of the greater depth that naturalists have sounded.

EXPANDING THE DISCUSSION

I therefore propose to widen the scope of diversity by dividing it into three levels, each one subject to a different set of criteria producing complex correlations. The traditional focus on *biodiversity* (where the inventory of taxa is recorded) is expanded to explore *ecodiversity* (the receiving capacity or receptivity of habitats), and then further enlarged to investigate *sociodiversity* (the location of partners in ecosystematic strategies).

To offer a more concrete example, the following comparison can be made between two different ecosystems:

- A maple forest on the Montreal plain will contain some 30 *species* of vascular plants. Given the complexity of stratification, seasonal variation, and microrelief, the forest will offer 15 *ecotopes*. The species will be distributed widely on an *epharmonic* gamut, or among a variety of life forms, such as trees, shrubs, herbs, bulbs, and annuals.

- A beach transect in the Gaspé Peninsula will also contain about 30 *species*, but will offer only 2 *ecotopes*. Here the species will be distributed among only 4 *life forms*.

These are two cases where biodiversity is the same but where ecodiversity and sociodiversity are different. Evaluating landscapes on these three levels may help natural resource managers, conservation agencies, scientists, and governments to better understand the complexities of diversity and thus enable them to make wiser decisions about what to conserve.

Often the perception of the richness or poverty of flora and fauna is based on the rarity of certain taxa or the vulnerability of "threatened" species. Some defenders of nature have almost become dogmatic about our obligation to preserve for time immemorial all the species now living on our planet. Let us remember that preserving each species involves conserving its biological, ecological, and social aspects. First we must understand what is involved at each of the three levels; all the facts must be considered when determining how to preserve a species. But it still remains to define the three orders. Part 1 of this series will focus on biodiversity; Part 2, on ecodiversity; and Part 3, on sociodiversity.

BIODIVERSITY: THE HEREDITARY POTENTIAL

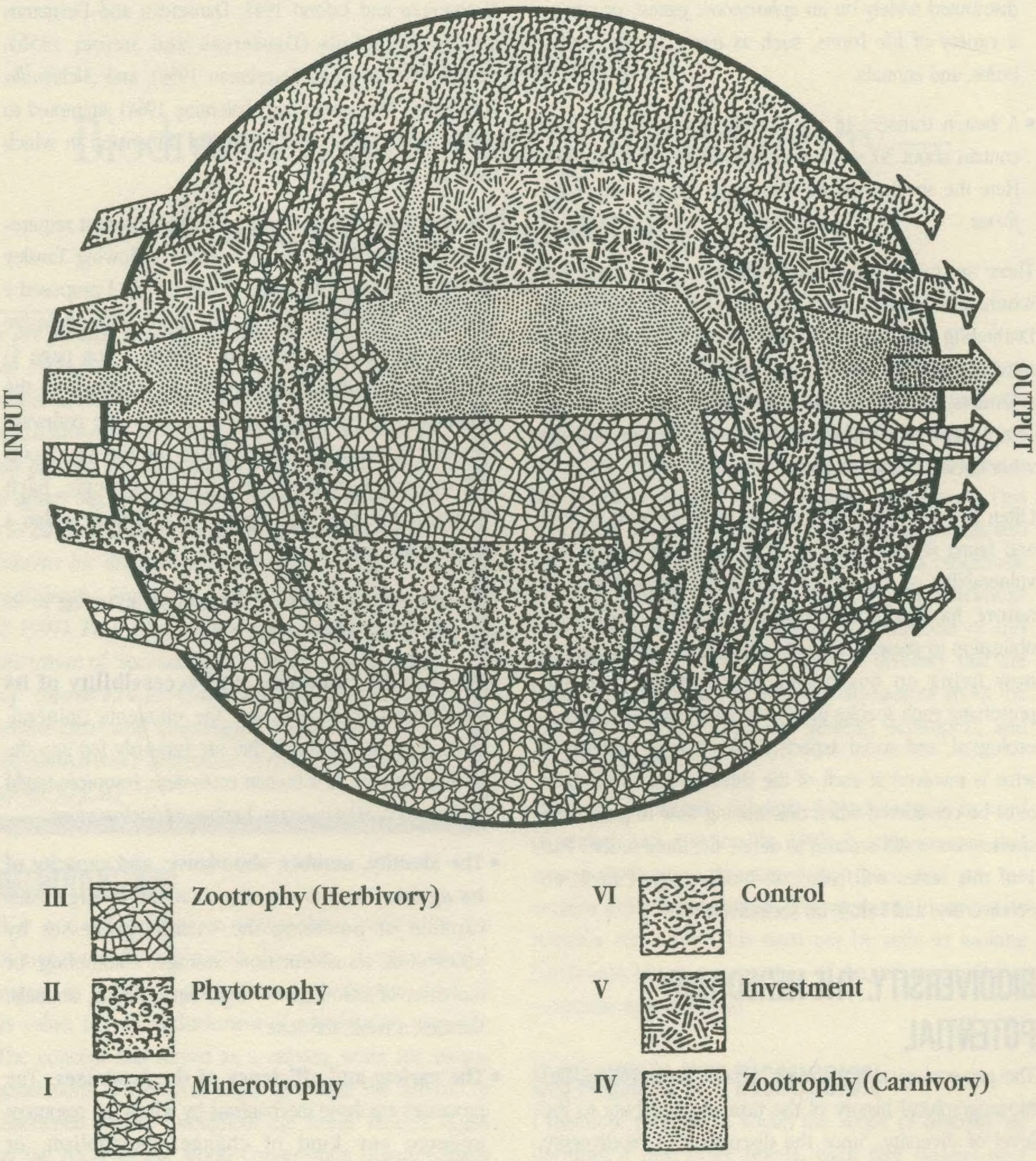
The geo-ecological framework, genetic composition, and biogeographical history of the taxa all contribute to the level of diversity. Since the discussion of biodiversity originates with the heredity of a species and the environment in which it finds itself, we must begin by testing the genetic potential of a species and exploring how it relates to the various orders of magnitude of the environment. In doing so, we can detect the *linkage of responses*, which is the very expression of diversity. In a great number of ecosystematic studies, the ecological dimension (stage or background) is almost always less well defined than the genetic complex. The admirable works of Clausen, Keck, and Hiesey (1940, 1945, 1948,) and Clausen and Hiesey (1958), in which I had the privilege of participating in 1949, have a very hard genetic and taxonomic definition, but a rather soft ecological focus. My own biosystematic studies on maples (Dansereau and Lafond 1941, Dansereau and Desmarais 1947), cinquefoils (Dansereau and Steiner 1956), cockleburs (Löve and Dansereau 1959), and *Alchemilla* (Bradshaw, Dansereau, and Valentine 1964) attempted to define more sharply the ecological dimension in which these species exist.

The interaction between genes and environment requires a unifying concept — the ecosystem. Following Tansley (1935), Lindeman (1942), and Odum (1953), I proposed a scheme in 1971 (1971a) that was more comprehensive and less exclusively "biological." Figure 1 (on page 4) shows the way this ecosystem model functions — the "ball-of-arrows." In the figure you can see the pathways of energy between six trophic levels and the way inputs and outputs interact with other ecosystems. Each ecosystem will, therefore, operate as one node within a complex network.

One ecosystem will differ from another according to its structure in four major ways:

- **The quality, quantity, and accessibility of its *resources*.** Resources are the elements (mineral, biological, or functional) that are variously fed into the cycling process. In a human ecosystem, resources might include iron, wheat, cattle, lumber, and information.
- **The identity, number, abundance, and capacity of its *agents*.** Agents are the elements or organisms capable of powering the various processes by absorption, transformation, storage, channeling, or transport of resources — e.g. wind, plants, animals, humans, a bank, the State.
- **The variety and efficiency of the *processes*.** The processes are those mechanisms by which the resources undergo any kind of change, metabolism, or transformation. Whether anabolic, metabolic, or catabolic, all processes imply an energy flow — e.g. pedogenesis, photosynthesis, absorption, predation, damming, electricity transmission, marketing, stock-exchange speculation, legislation.
- **The quality, quantity, pathways, and utility of its *products*.** Products are the objects or services that result from the processing of resources by agents; products are consumed, stored, lost, or reinvested for further cycling — e.g. humus, starch, flesh, the automobile, a poem. The product arising at one level will become a resource at another level, or be stored, lost, or transferred to another ecosystem.

Figure 1.
MODEL OF THE ECOSYSTEM
At each one of the *six trophic levels* of this "ball-of-arrows," the interplay of *resources — agents — processes — products* is powered by an energy flow that favours the transfer (ascending or descending arrows) from one level to another. This internal movement (rarely auto-related) is accompanied by an *input* of resources at one or another of the levels (arrows entering at the left), and by a corresponding *output* of products or wastes (arrows exiting at the right). (Dansereau 1971a, 1976, 1987)



The functioning of an ecosystem will be expressed in the uneven distribution of its *trophic loads* — the intensity at each level of the resource cycling from one level to another within time and space. This functioning will also be expressed by the autoregulation of internal exchanges and by the level of dependence on the *input* it receives from other ecosystems and the *output* it delivers to other ecosystems.

Figure 2 represents a network of ecosystems centred on an orchard. Look at the differences in internal cycling and external exchanges among the individual ecosystems. Each ecosystem is characterized by the uneven distribution of the trophic loads. The orchard itself shows no carnivorous activity (level IV, zootrophy), but carries its major trophic load at level II (phytotrophy); the major load of the agricultural-instrument factory is at level V (investment), and the labour union at level VI (control).

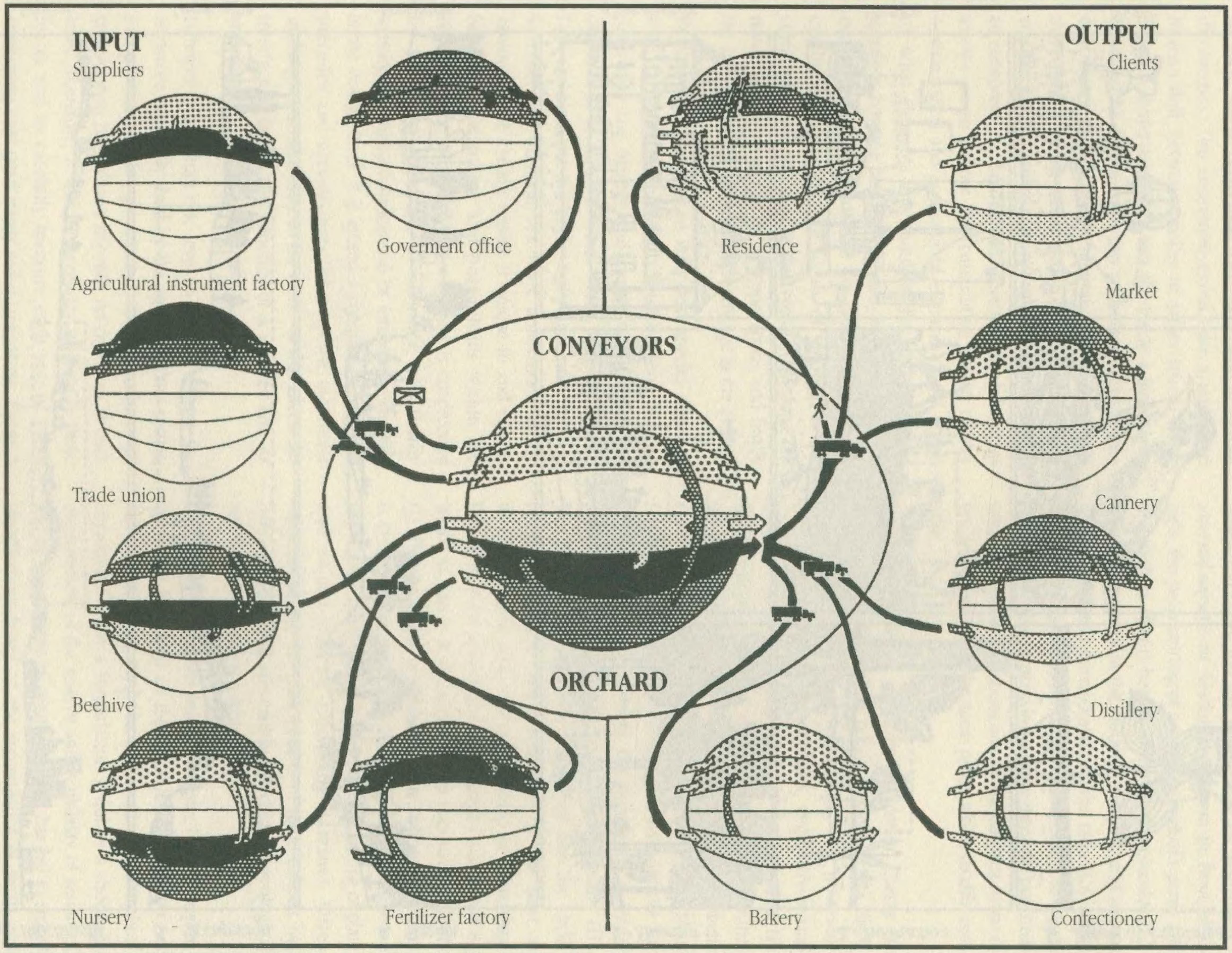


Figure 2.
A NETWORK OF ECOSYSTEMS CENTRED ON AN ORCHARD
Each "ball-of-arrows" (see Figure 1) is graded according to its trophic load (less or more heavy: from white to black) carried at each trophic level. The *supplier ecosystems* direct their *input* (by means of a conveyor) to a particular trophic level of the *recipient ecosystem* (here, an orchard). The *client ecosystems* (on the right) receive the *product* (*output*, now a resource) in the same way at any given level.

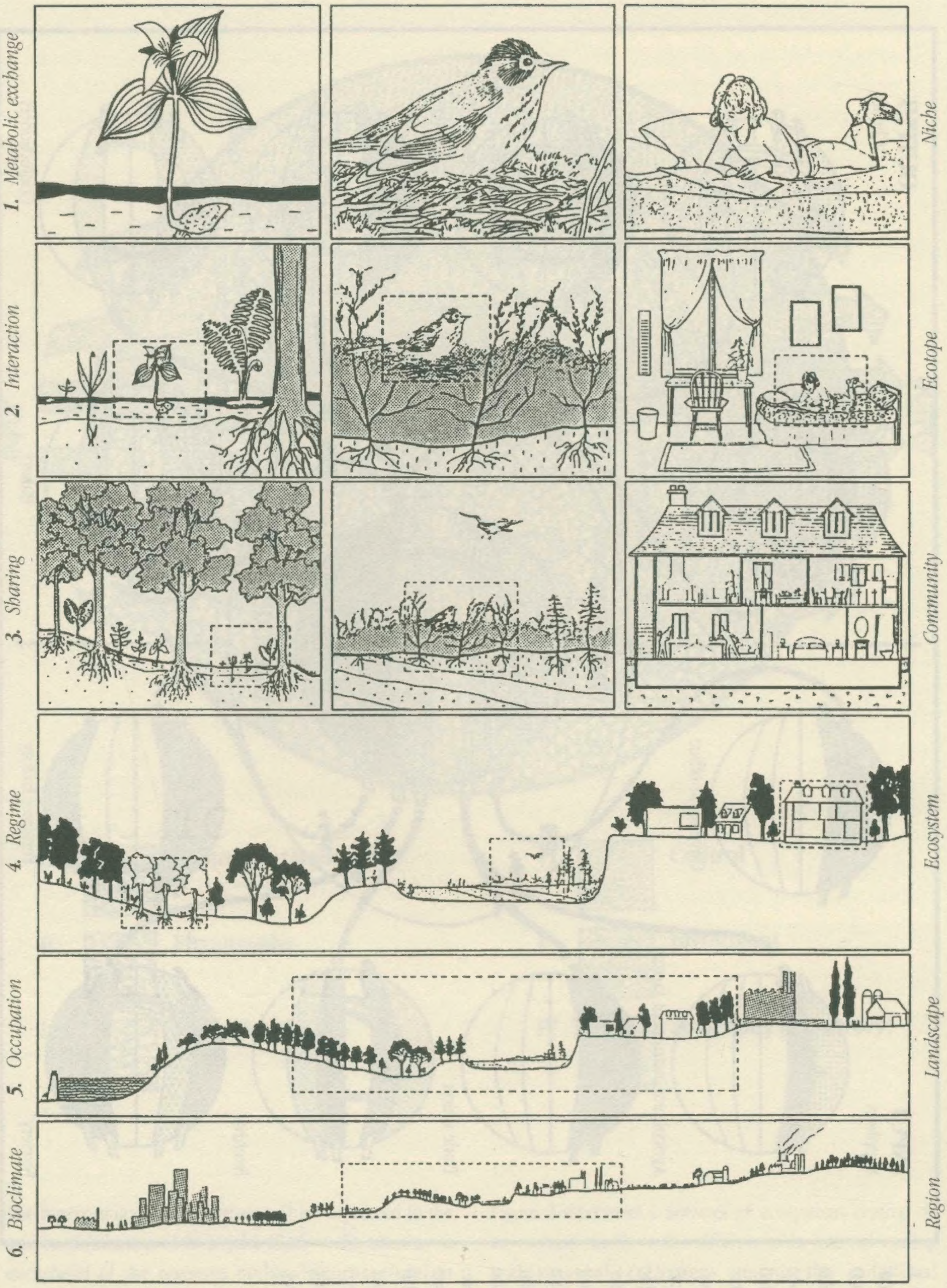


Figure 3.
ADJUSTMENT TO THE ORDERS OF MAGNITUDE OF THE ENVIRONMENT

A plant, the white trillium *(Trillium grandiflorum)*, an animal, the palm warbler *(Dendroica palmarum)*, and a young girl *(Homo sapiens)* are seen in their ecological niches, the place of their metabolic exchanges. At increasing orders of magnitude, the *environmental unit* is identified (on the right) and its *dominant process* (on the left).

In turn, each ecosystem exhibits limited spatial dimensions. The ecosystem exists, like a mid-sized Russian doll, between smaller or larger spatial units. Figure 3 shows how each unit fits inside a larger one. Reading the figure from top to bottom reveals the dependence of each smaller unit on its enveloping unit: there can be many *niches* within an ecotope, several *ecotopes* within a community; several *communities* within an ecosystem, etc. Reading the figure from the bottom up allows us to follow the cumulative effect of the meteorological and geographical elements of the region on what elements are found in the landscape and therefore, how the landscape is used; how the individual ecosystems in the landscape are conditioned by the cycling regime; how the forms of sharing in the communities are governed by the type of ecosystems; the nature of interactions in the ecotopic space; and finally the accomplishment of metabolic exchange in the niche.

By looking at the way an individual species connects with the other levels of its environment we can determine the origins and controls that reach the organism in its niche, in other words, its *host capacity.* Light and heat (cosmic) hit the *region* uniformly; soil and its relief and drainage are basic dimensions of the *landscape*; the cycling *regime* is unique to and reflects both the constraints and possibilities within the ecosystem; the *accessibility* of resources is conditioned by the structure of the *community*; and finally *sociological interactions* increase or inhibit opportunities at the *ecotope* level. It is indeed a complex filtering that precedes and accompanies the eventual *metabolic exchanges* that take place in the niche, or that affects the interface between the genetics of a species and its environment.

Different forces, from one level to another, convey the resources eventually used by the agents to their niches, using compatible processes. The production/consumption ratio always depends on pressures at each level. Therefore, it will be necessary to identify these forces and to carefully measure each one of these enveloping units qualitatively and quantitatively. Figure 3 places the ecosystem at the centre of a range of environmental units, which are ruled by processes subject to an uneven level of ecological inputs.

The linkage of responses, which affects the evolution and development of a species, is represented in Figure 4 on page 8. Here, the individual is at the centre between two arcs: the bottom arc represents the individual's *internal adaptation*; the top arc represents the individual's *external adjustment.* Reading the bottom arc from left to right, the programming of a living individual's genes and morphology (form) begins in the DNA molecules (A), which are present in the chromosomes (B), and in turn impose a limited development on the cells (C), which regroup into tissues (D) and then differentiate into organs (E). The actual expression of the genetic potential undergoes many inhibitions among the different forms of the genes occupying the same place, which modify each other.

No species, however, develops in isolation. During the growth and differentiation period, outside factors (light, heat, humidity...) may affect various vital processes internally, resolving, for instance, vegetative/sexual conflicts. The external adjustment of the individual (F) first develops within the population (G), which either allows a certain genetic variation or fixes the genetic make-up through apomixis (reproduction without fertilization). In turn, according to its aptitude for cooperation or competition, the population is under pressure from the other members of the community (H). The community must then insert itself into the cyclic rhythm (the regime) of the ecosystem (I). The latter, as we have already seen, can only develop in a landscape that offers it the appropriate physiography and resources, which in turn is at the mercy of the regional bioclimate (J). There remains an ultimate square, whose dimension is even larger in space, and above all, in time. These are the biota (K), large geographic cohorts or groups of plant and animal families (including humans). Often transcontinental, the phylogenesis of these cohorts has been gravely and irreversibly affected by geological events and by their own migrations.

To explain the reasons behind diversity I am, therefore, offering a hypothesis on the effects the environment has on the potential and the demands of individual organisms. Such a formulation requires a thorough measurement of the reserve and availability of resources and of the capacity of organisms. This has led to spatial classifications based on the accumulation of yields and stresses in the ecosystems (forest, marsh, dune, etc.) and on the distribution at three levels: genetic (taxonomic), physiological, and social.

An example will serve to illustrate my point. The Brazilian mangrove occupies a clay intertidal zone in a wet tropical climate where the plant communities have adapted to the mechanical effects of the tides, the instability of the substratum, and the salinity. The three dominant tree species, which are found in the zone that encompasses all ecosystems on the Atlantic shores, have very different responses in the mangrove environment. Here the associated species draw upon very limited resources (Dansereau 1947). What will be found in the three levels of diversity can be summarized as follows. On the level of *biodiversity,* we find a very restricted number of plant and animal species (compared with the adjacent tropical rainforest). On the level of *ecodiversity,* the stressful influences of the rhythmic flooding and salinity do not allow a broad range of physiological responses, since they demand very narrow adaptation. Finally on the level of *sociodiversity,* the interactions between the water, soil, plants, and animals follow a prescription that allows no great abundance of partners.

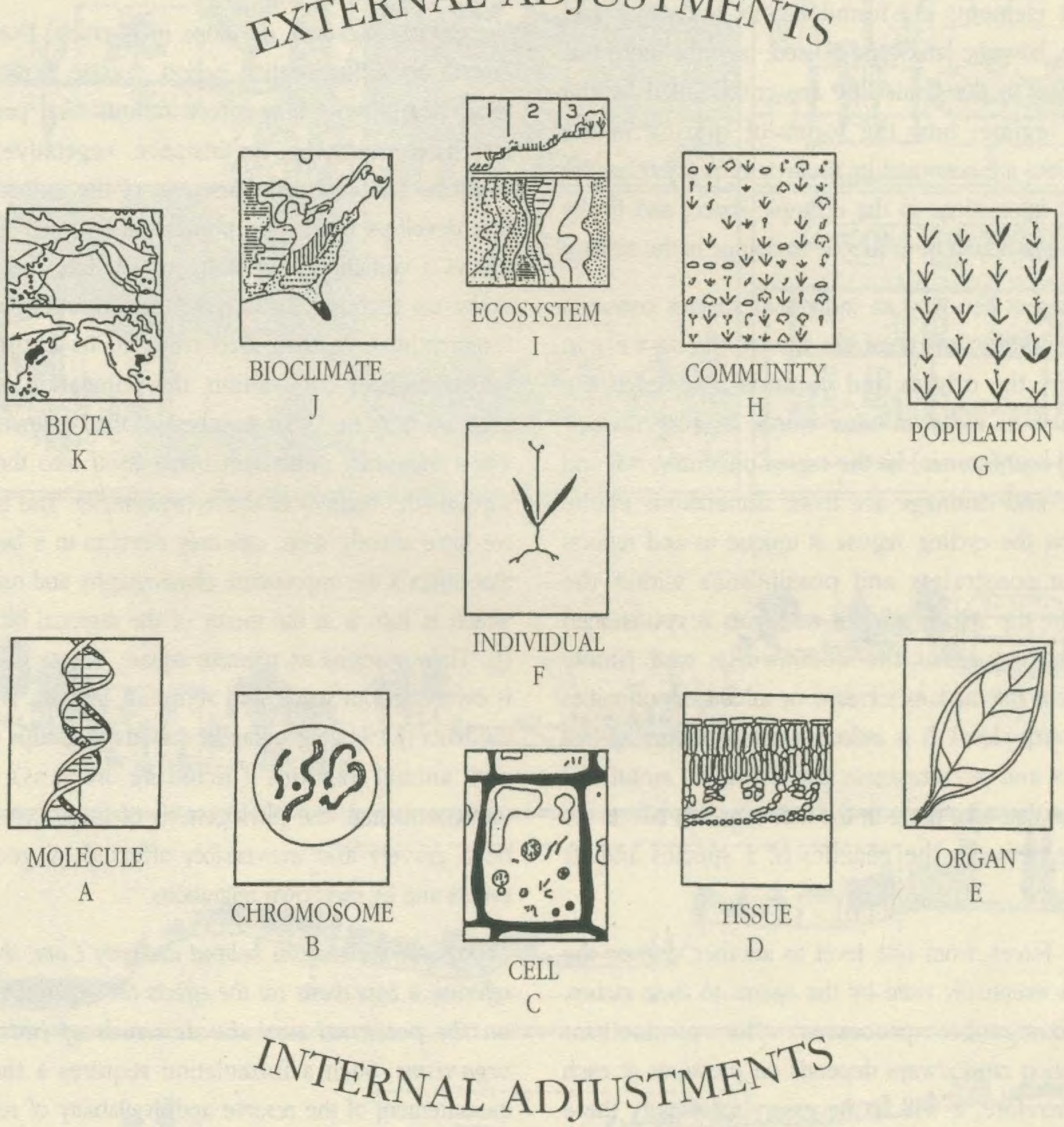


Figure 4.
THE LEVELS OF BIOLOGICAL INTEGRATION OF A PLANT
In the centre, the individual whose programming is transmitted (lower tier) from the DNA molecule, to the chromosomes, the cell, the tissue, and the organ. Within this *autecological* framework, the environment restricts full expression of the hereditary stock. On the upper tier, intraspecific and interspecific competition/cooperation further enhance or limit the population's potential and *synecological* exchanges with other members of the community. The latter shows further *dynecological* adjustment at the levels of the ecosystem and the bioclimate, and on a geological time-scale, the biota (Dansereau 1964, 1976).

Such are the bearings on the "theater of the environment" where "the drama of evolution" unfolds (Hutchinson 1965). By studying the linkage of responses we can better determine where an individual fits into the levels of diversity. But without a more precise knowledge of the genetic adaptations that limit an individual's access to resources and its mode of uptake, and of the dynamic structures of the ecosystems that harbour and condition the individual, we cannot accurately interpret such an interdependence.

To sum up, *biodiversity* is measured by the number of taxa occupying a given space. The heredity of each one of these taxa is more or less rich, stable, and efficient. The consequences of such richness are genetic and ecological, combining to develop a *potential* that is available or pre-adapted to the offerings of the environment and more or less responsive to edaphic or climatic change.

REFERENCES

Bouchard, André, Denis Barabé, Madeleine Dumais and **Stuart Hay.** 1988. *Les plantes vasculaires rares du Québec.* Musées Nationaux du Canada, Ottawa, Syllogeus N° 48, 79 pp.

Bradshaw, M. E., Pierre Dansereau and **David Valentine.** 1964. Notes on the genus *Alchemilla* in Southeastern Canada. *Canadian Journal of Botany* 42(1): 89–104.

Burnett, James A., T. Charles Dauphiné Jr., Sheila H. McCrindle and **Ted Mosquin.** 1989. *On the brink: endangered species in Canada.* Western Producer Prairie Books, Saskatoon, viii + 192 pp.

Clausen, Jens, and **William M. Hiesey.** 1958. Experimental studies on the nature of species. IV. Genetic structure of ecological races. *Carnegie Institution of Washington Publication* 615, Washington, D.C., vii + 312 pp.

Clausen, Jens, David D. Keck and **William M. Hiesey.** 1940. Experimental studies on the nature of species. I. Effect of varied environments on western North American plants. *Carnegie Institution of Washington Publication* 520, Washington, D.C., vii + 452 pp.

Clausen, Jens, David D. Keck and **William M. Hiesey.** 1945. Experimental studies on the nature of species. II. Plant evolution through amphiploidy and autoploidy, with examples from the Madiinae. *Carnegie Institution of Washington Publication* 564, Washington, D.C., vii + 174 pp. + plates.

Clausen, Jens, David D. Keck and **William M Hiesey.** 1948. Experimental studies on the nature of species. III. Environmental responses of climatic races of *Achillea. Carnegie Institution of Washington Publication* 581, Washington, D.C., iii + 129 pp.

Dansereau, Pierre. 1947. Zonation et succession sur la restinga de Rio de Janeiro. I. Halosère. *Revue Canadienne de Biologie* 6(3): 448–477.

Dansereau, Pierre. 1952. The varieties of evolutionary opportunity. *Revue Canadienne de Biologie* 11(4): 305–388.

Dansereau, Pierre. 1964. The future of ecology. *BioScience* 14(7): 20–23.

Dansereau, Pierre. 1971a. Dimensions of environmental quality. *Sarracenia* 14: 109 pp.

Dansereau, Pierre. 1971b. The variety of coenotypes in vascular plants and the spectrum of their distribution in several communities. I. Definition and test. *Naturaliste Canadien* 98(3): 359–384.

Dansereau, Pierre. 1976. *EZAIM: Écologie de la Zone de l'Aéroport International de Montréal. Le cadre d'une recherche écologique interdisciplinaire.* Presses de l'Université de Montréal, xviii + 343 pp.

Dansereau, Pierre. 1987. Les dimensions écologiques de l'espace urbain. *Cahiers de Géographie du Québec* 31(84): 333–395.

Dansereau, Pierre and **Yves Desmarais.** 1947. Introgression in sugar maples. II. *American Midland Naturalist* 37(1): 146–161.

Dansereau, Pierre and **André Lafond.** 1941. Introgression des caractères de l'Acer saccharophorum K. Koch et de l'Acer nigrum Michx. *Contrib. Inst. Bot. Univ. Montréal* 37: 1–14.

Dansereau, Pierre and **Erich E. Steiner.** 1956. Studies in Potentillae of high latitudes and altitudes. II. Central Baffin Island populations. *Bulletin of the Torrey Botanical Club* 83(2): 113–135.

Hutchinson, G. Evelyn. 1965. *The ecological theater and the evolutionary play.* Yale University Press, New Haven, xiii + 139 pp.

Lindeman, Raymond L. 1942. The trophic-dynamic aspect of ecology. *Ecology* 23(4): 399–418.

Löve, Doris and **Pierre Dansereau.** 1959. Biosystematic studies on *Xanthium:* Taxonomic appraisal and ecological status. *Canadian Journal of Botany* 37(2): 173–208.

Odum, Eugene P. 1953. *Fundamentals of ecology.* W. B. Saunders, Philadelphia, xii + 384 pp.

Tansley, A.G. 1935. The use and abuse of vegetational concepts and terms. *Ecology* 16: 284–307.

Watch for Part 2, on ecodiversity, in Summer 1997, and Part 3, on sociodiversity, in Fall 1997.

Lighting a sacred fire

Naigzy Gebremedhin

Noble visions are needed to guide the world towards worthy goals. Such visions may come from countries both great and small and it behooves us all to listen. Global biodiversity *is therefore honoured to bring to its readers the inspiring words of Naigzy Gebremedhin, from Eritrea, based on his speech in the Ministerial section of the Conference of the Parties of the Biodiversity Convention (COP-2) held in Jakarta in 1995. The speech has since been updated. [D.E.M.].*

When I was 11 years old, I adopted an Indonesian hero, having read about the exploits of a guerrilla fighter named Utong Surobati. His exploits captured my imagination as did none other. One episode — the reaction of the colonial powers following Utong Surobati's daring rescue of the Dutch girl he loved from the Fortress of Batavia and the riots that resulted as a consequence — stands clearly in my mind.

As an impressionable 11 year old, I condemned the suppression of innocent love. Although my 11-year-old's sense of justice was shattered, over the years I kept a tiny sacred fire burning in the corner of my heart for my Indonesian hero and the Indonesian crowd that rioted against injustice.

Fifty years later, at age 61, I am the Executive Director of the Eritrean Environmental Agency. I see this position as an opportunity to rekindle that sacred fire, and start some new ones. What experiences can Eritrea, barely five years old, a small country of 3 million people, a country shattered by 30 years of war, bring to the Conference of the Parties to the Convention on Biological Diversity (CBD)?

First, we bring our tangible actions and plans for the future. Eritrea ratified the Convention on 11 September 1995, then discussed its biological diversity strategy at a national conference on 21–23 November 1995, and finally, became a full Party on 11 December 1995. Subsequently a task force developed the strategy in 1996, including draft legislation on protecting biological diversity. A series of consultations will be held with the people in 1997, and both the strategy and legislation are expected to be adopted before the beginning of 1998.

A second gift, and more important, is our belief in sacred fires. We believe that there are certain sacred fires burning within all of us that should never be extinguished. Allow me to mention a few:

- We should never extinguish the sacred fired that expresses our outrage against extinction, against the loss of biological diversity.
- We should never extinguish the sacred fire that epitomizes our reverence of living things.
- We should never extinguish the sacred fire that nurtures the sense of awe that comes from realizing how much greater an architect nature is than we are. Call him or her by whatever name you wish.
- We should never extinguish the sacred fire that commits us to the well-being and continued prosperity of indigenous peoples. We should not pay lip service to indigenous peoples' participation but rather seize every opportunity to encourage people to make development happen.

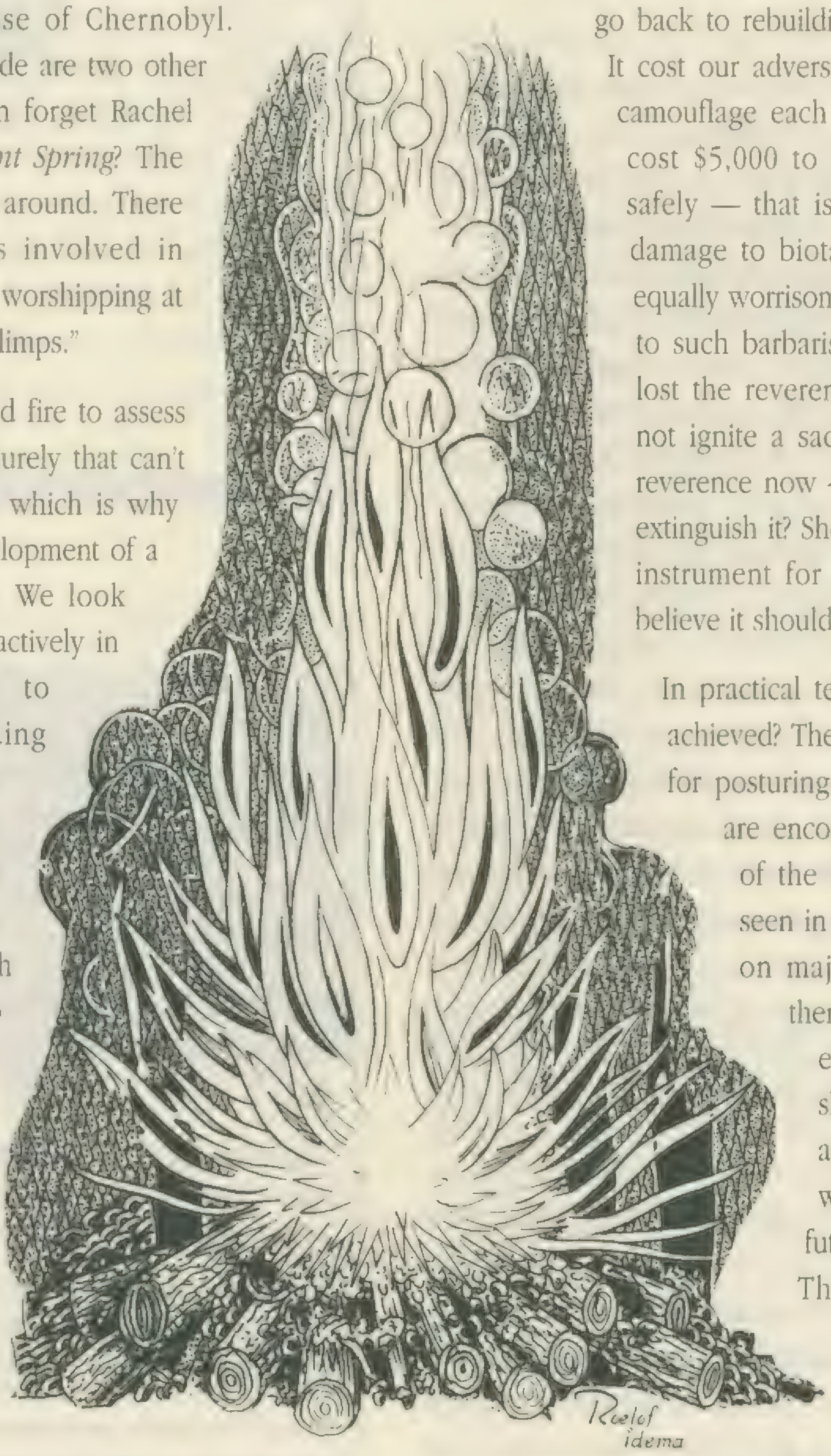
So much for maintaining existing sacred fires. What about new sacred fires? We should ignite sacred fires where none exists and where such are likely to be useful in protecting biological diversity. Again, allow me to mention a few.

- We should ignite a sacred fire against profligacy and waste. The propensity to consume must be tempered by an obligation to conserve biological diversity, in keeping with the third preambular paragraph on the Convention.

Naigzy Gebremedhin, Senior Advisor, Eritrean Environmental Agency, P.O. Box 5713, Asmara, Eritrea

- We should ignite a sacred fire that assesses and reviews the role of technology. Over the years I have come to realize that we tend to overstate technology. Some years ago a book was published depicting technology as "a god that limps." In some societies, technology is worshipped as a god, a god whose considerable limp is supported by an assortment of crutches and walking sticks. Remove the sticks and it can crush, deform, deface, and pulverize those in its vicinity. Indeed, in some cases, defacement and destruction affects those far away. Remember that Sweden had to shoot 30,000 reindeer because of Chernobyl. Minamata and Thalidomide are two other examples. And who can forget Rachel Carson's book *The Silent Spring*? The "god that limps" is still around. There are considerable risks involved in slavishly and uncritically worshipping at the altar of the "god that limps."

- We should ignite a sacred fire to assess the extent of the limp. Surely that can't be wrong or misguided, which is why Eritrea supports the development of a protocol on bio-safety. We look forward to participating actively in the negotiations and to contributing to building consensus on this issue. We note that some countries are skeptical about this issue, but we are willing to work with them. We are willing to work with those countries that associate any proposed protocol as a barrier or obstacle to progress. As developing countries we cannot be against progress.



- We should ignite a sacred fire that would make the CBD a true instrument of peace — a vital dimension of environmental security. Eritrea is a country that cherishes peace — peace achieved after three decades of war and destruction. It is the most precious possession we have, and what a wonderful possession it is. We wish all the people of the world peace. We identify strongly with people whose peace is threatened by those who rattle their sabres, by those bent on dictating and dominating — and we aren't differentiating between *in-situ* or *ex-situ* domination. We identity with people whose security and peace is threatened by those who test weapons of mass destruction. We feel the anguish of people from Australia to Vanuatu. We identify with the ordinary people of Angola, Afghanistan, and Mozambique. Eritrea has one million anti-personnel land mines that are randomly placed and randomly maiming innocent men and women who are trying desperately to go back to rebuilding their shattered lives. It cost our adversaries $0.50 to hide and camouflage each of these killers. It will cost $5,000 to remove each of them safely — that is, if we are lucky. The damage to biota and to animal life is equally worrisome. Why did we descend to such barbarism? Isn't it because we lost the reverence for life? Should we not ignite a sacred fire to affirm such reverence now — and resolve never to extinguish it? Should not the CBD be an instrument for peace? We, in Eritrea, believe it should.

In practical terms, how is this to be achieved? There should be little room for posturing and confrontation. We are encouraged by the goodwill of the Parties to the CBD, as seen in the consensus achieved on major issues. We believe there should be a genuine effort to build partnerships. There is no other alternative, particularly if we wish our common future to be a bright one. There is little room for exclusionary tactics, or for staking our claims — intellectual or otherwise, or for turning the biological diversity debate into the haggling of market traders or managers of "supermarkets." The exigencies of a common future dictate that we create effective partnerships. At the very least, we should share information openly and with a great deal of magnanimity.

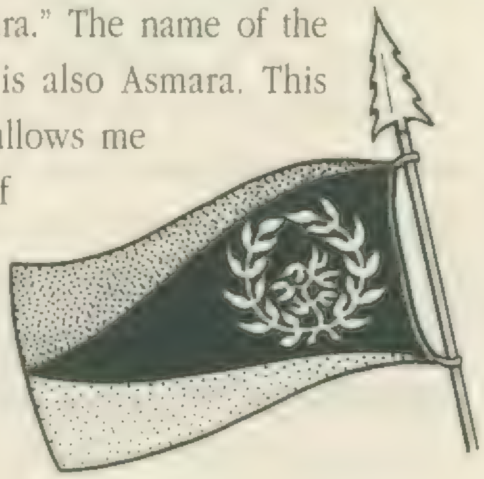
We should never extinguish the sacred fired that expresses our outrage against extinction, against the loss of biological diversity. We must keep burning the sacred fire that represents our reverence for living beings.

In this regard I am deeply impressed with ECOMAN, an initiative of the Swiss Peace Foundation, which is a scientific research partnership with developing countries for sustainable development. I wonder if this is not a model to emulate. The ECOMAN Project is now fully operational, bringing together four research teams from Ethiopia, Eritrea, Sudan, and Somalia. With a group from Switzerland, the teams are carrying out research on environmental conflict management and consensus building. The teams have had several fruitful discussions as they continue to analyse successful conflict-resolution approaches.

If the CBD is to be an effective instrument for peace, it needs to build a number of bridges to other conventions directly related to its mandate. In our view, the CBD Secretariat should begin liasing with the organs entrusted with the implementation of the Convention on the Prohibition of the Development, Production, and Stockpiling of Biological and Toxic Weapons, popularly known as the Biological Weapons Convention of 1972. We are not suggesting that any substantive work be initiated in respect to biological weapons — given the apparent lack of expertise and mandate for such an initiative. Building a bridge to the Biological Weapons Convention might, for example, simply entail the designation of someone in the Secretariat who would become a resource person on the subject, someone who knows who knows what and who does what in this area. UNEP and its centres of excellence, such as the SIPRI (Stockholm International Peace Research Institute) and PRIO (International Peace Research Institute, Oslo), used to be the international locus for such information. When the relevant program, Peace and Security, was dismantled in 1989, the international coordinates for such information became unclear. It is time for this problem to be addressed.

There is one last sacred fire we should ignite. This concerns self-reliance — a message particularly addressed to those of us who fall under the category "least developed countries." We suggest that complete self-reliance is a myth. We should, therefore, have a realistic appreciation of the imperative of interdependence. Some of our obligations under the Convention can only be fulfilled and addressed jointly. What is important, however, is that we do not turn to others when we should turn to ourselves. In this regard I wish to say that the CBD Secretariat faces a daunting task. It is important that it not try to do too much. Equally, we should not ask it to do too much. We must do what we have to do. We must not fail to take hold of the opportunity to act. We must not fail to act decisively when we know we must.

The other day I was told that the Indonesian word for love is "Asmara." The name of the capital city of Eritrea is also Asmara. This fortunate coincidence allows me to beg the countries of the world to accept our "asmara" from Asmara, Eritrea.



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Biodiversity and the Bible

Calvin B. DeWitt

Is it surprising that thoughtful contemplation of deeply held beliefs and tenets in this world of unending change should produce new insights? It is only surprising, perhaps, that we don't meditate more about these guideposts to life or that we don't always think that all things created are precious. Legislative speakers and leaders may be taken aback in the months and years to come! (See also "A Charter for Earth" in Biodiversity Initiatives and Successes on page 27.) [D.E.M.]

INTRODUCTION

Over the past century, the focus of most religious groups has been on human beings. Now, however, there are powerful and effective calls to environmental stewardship and protection of God's creation, creatures, and their habitats. The result is an awakening of people and governments to human responsibility for natural biodiversity.

In their Joint Appeal by Religion and Science for the Environment in Washington, DC in 1992 some 250 key leaders in religion and science signed a statement in which they agreed to set aside their differences to work together to address the state of the global environment. This in turn resulted in the formation of the National Religious Partnership for the Environment in 1993 — a partnership among four US religious groups: the Coalition on the Environment and Jewish Life, the United States Catholic Conference, the National Council of Churches, and the Evangelical Environmental Network (EEN) — all of which adhere in varying degrees to the teachings of the Bible, and thus are all "People of the Book."

Dramatically, on 31 January 1996, the evangelical quarter of the partnership announced at a news conference in Washington, that the *"Endangered Species Act* is OUR Noah's Ark— Congress and special interests are trying to sink it!" (See *Global biodiversity* 5(4): 20–21 for more details.) Coming at a time when legislation was being proposed that would seriously weaken the current Act, this timely pronouncement was picked up by all of the major radio, television, and print media, including "As it Happens" on CBC radio and "All Things Considered" on National Public Radio. The story of Noah — until then considered archaic and irrelevant by many — emerged in an instant, dramatically altering the ground on which endangered species and biodiversity were being argued. Many conservative members of the US Congress came to recognize that responsibility before their Creator superseded all other interests, and that this responsibility included stewardship of the Earth. At the same time moderate and liberal members "unpacked" the story they had learned as children, finding some persistent truths that transformed their thinking.

Recorded in chapters 6 through 9 in the book of Genesis, the story of Noah addresses many pressing current questions: Is saving species more important than saving people? (It depends on how responsible they are!); Are only species with actual or potential utilitarian uses important? (Useful animals are taken into the Ark by sevens, but pairs of those with no human use are also saved.); Is the Creator determined to save the creatures even today? (The answer is yes — as affirmed in Genesis 9 in God's covenant with all life, the Earth, and every creature — signified from then until now by the rainbow.)

The Noah story is part of the larger biblical principle of "fruitfulness." This principle, together with the biblical principles of "earthkeeping" and "sabbath," constitutes the core of biblical ecological teaching. While the

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Fruitfulness Principle — through the story of Noah — has made the news and penetrated the halls of the US Congress, the other two could do so as well in coming months and years. Because of their substantial impact, and potential continuing impact, it is important that these principles are understood by people interested in biodiversity.

EARTHKEEPING

Genesis 2:15 is the focal point of the Earthkeeping Principle. Here, near the beginning of the Bible, Adam ("adam" is also the Hebrew word for "humankind") is placed in the garden to "till" and to "keep" it. While the word "till" conveys the concept of stewardship moderately well, the meaning of "till" in the original Hebrew is more profound. Simply, it means Adam is expected to *serve* the garden, which makes more sense than the modern, narrower sense of "till," when one remembers that the garden here has been planted by the Creator and thus was not likely planted in rows or suited to tilling by modern hoes, shovels, or plows.

In return, the garden is to serve the biosphere, and in its esthetic and nutritional senses, also serve people. But note that the garden's service is reciprocated with human service. Thus, human service is joined *with* that of the garden — it is a *con*-service. It is "service *with*" — *con*-servancy, *con*-servation.

EARTHKEEPING: "Shamar" means that the Earth is to be kept by human beings in its wholesome fullness — with its vibrant, lively, dynamic character intact.

The second focal word in this passage, the word translated "keep," brings us directly to *earthkeeping*. It comes from the Hebrew word, "shamar," which has a rich and full meaning — rather than preserving as one would pickles in a jar, it conveys the idea of keeping the dynamic qualities of the thing being kept. When used in the invocation of the Aaronic blessing, the word *shamar* leads one to expect God to keep people physiologically and psychologically as well as relationally with others — relatives, other people, other creatures, soil, water, and air. It is a rich, full, and fulfilling "keeping."

Applied to keeping the garden, "shamar" means that the Earth is to be kept by human beings in its wholesome fullness — with its vibrant, lively, dynamic character intact. In the Jewish tradition "shamar" is recognized in the name of the environmental organization, Shomrei Adamah — Keepers of the Earth.

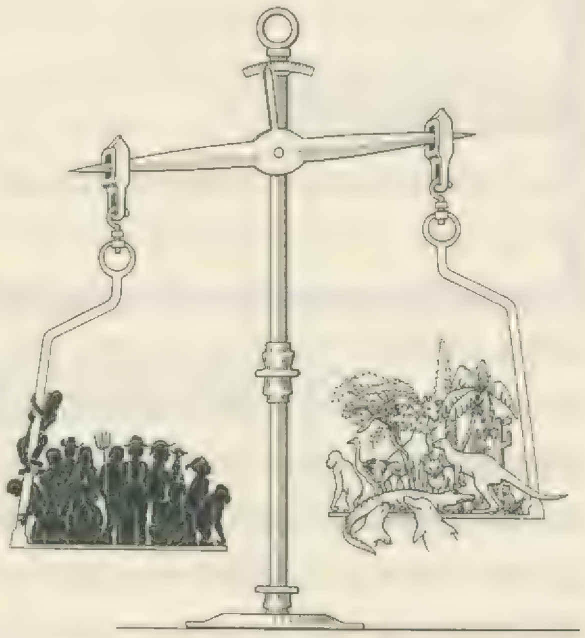
If the Earthkeeping Principle is applied today, humans then are to *keep* the Creation, making sure that the creatures under human care are maintained with all their proper connections intact — internal ones within their own selves, and external ones with members of their species, other species, the soil, the air, and the water upon which they depend. The rich and full keeping we invoke in the Aaronic blessing is the kind of rich and fulfilling keeping that we should bring to the garden of God — to God's creatures and to all of Creation.

FRUITFULNESS

The Fruitfulness Principle is best known from Genesis 1, "Be fruitful and multiply." It is a blessing given to people, but again note, it is not given to humans first. Instead, its first occurrence is the blessing to fish and birds: "Let the water teem with living creatures, and let birds fly above the earth across the expanse of the sky" (Genesis 1:20). "Be fruitful and increase in number and fill the water in the seas, and let the birds increase on the earth" (Genesis 1:22). A few verses later (Genesis 1:28) it is given to people: "Be fruitful and multiply and replenish the earth, and subdue it: and have dominion." How, then, can human beings interpret this to mean that their blessing is given at the expense of the blessing to the other creatures? Instead, the Creator blesses the Earth so that *all* creatures will flourish with great abundance and diversity. Moreover, the Hebrew word translated as "fill," used here both for human and animal populations has to do with *flourishing*, rather than overpopulation. It has to do with bringing to pleasant fullness, to fulfillment, to fruition.

The Fruitfulness Principle is also portrayed in the book of Deuteronomy: "If you come across a bird's nest beside the road, either in a tree or on the ground, and the mother is sitting on the young or on the eggs, do not take the mother with the young" (Deuteronomy 22:6). Thus, the lineage of the species must be preserved. If one must take the eggs or young, the mother must live so she can produce another clutch. If the mother were old and raising her last brood, a diligent interpreter of this law likely would not even take the eggs or young.

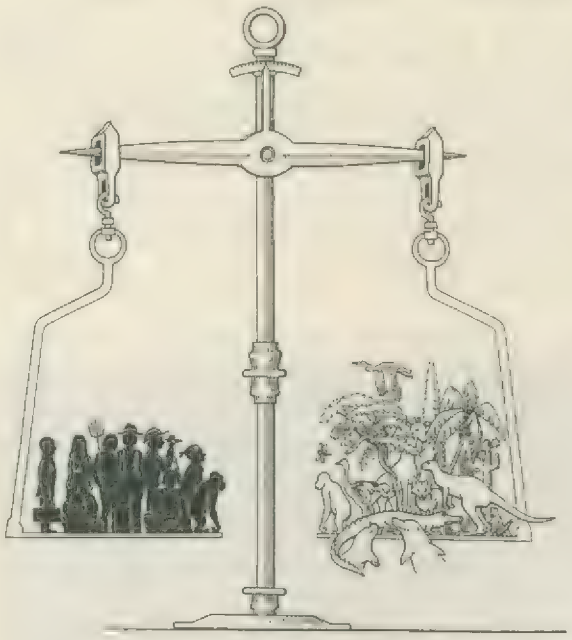
Fruitfulness is also illumined in some biblical references to pastures, water, sheep, and people. Psalm 23 puts the green pastures and quiet waters of nature into the context of human use, while the prophet Ezekiel comments on the abuse of the fruits and fruitfulness of creation: "Is it not enough for you to feed on the good pasture? Must you also trample the rest of your pasture with your feet? Is it not enough for you to drink clear water? Must you also muddy the rest with your feet?" (Ezekiel 34:18) Here there is a message that people should feed on the fruits of creation responsibly in a manner that does not destroy or degrade creation's fruitfulness.



The Fruitfulness Principle thus combines human responsibility and the goal of flourishing fulfillment for all the Earth's remarkable biological diversity. Humans are expected to enjoy Creation and its fruits, not to destroy the *fruitfulness* upon which Creation's fullness depends. Thus, humans must preserve the capacity of the land, water, and air to sustain flourishing life. And, as Noah spared no time, expense, or reputation when God's creatures were threatened with extinction, neither should we. Thus we must, with Noah, save the species whose interactions with each other, and with land and water, form the fruitful fabric of the biosphere — of creation.

SABBATH

The Torah teaches, "Remember the sabbath day by keeping it holy" (Exodus 20:8; Deuteronomy 5:12). Neither people nor animals should be relentlessly pressed but allowed to "get off the treadmill" so that they can enjoy both themselves and the wider creation — so they can recuperate and recreate. Moreover, as the sabbath of the week must be observed, so should the sabbatical year be observed. The Torah teaches, "in the seventh year the land is to have a sabbath of rest, a sabbath to the Lord" (Leviticus 25:4), and Exodus 23:10–11 commands, "For six years you shall sow your land and gather in its yield; but the seventh year you shall let it rest and lie fallow, that the poor of your people may eat; and what they leave the wild beasts may eat." You may ask, 'What will we eat in the seventh year if we do not plant or harvest our crops?' (Leviticus 25:20). God's answer in Leviticus 25 and 26 is: "I will send you such a blessing in the sixth year that the land will yield enough for three years." In other words, do not worry, but practice this law so that your land will be *fruitful.* "If you follow my decrees and are careful to obey my commands, I will send you rain in its season, and the ground will yield its crops and the trees of the field their fruit."



The law of the sabbatical year is given to protect the land from relentless exploitation, to help the soil, the heart of the land, rejuvenate. The law allows nature to restore itself. The scriptures warn that failure to give the land its rest will result in the land no longer supporting people and they will be driven off. "Then the land will enjoy its sabbath years all the time that it lies desolate…the land will rest and enjoy its sabbaths…the rest it did not have during the sabbaths you lived in it" (Leviticus 26:34–35).

This practice is still being used today by some farmers. For instance, a farmer in Neerlandia, Alberta — a hog farmer who practices the sabbath for the land — lets his land rest every two years, rather than every seven. When

FRUITFULNESS: How can human beings interpret the words "Be fruitful and multiply…" to mean that their blessing is given at the expense of the blessing to the other creatures? The Creator blesses the Earth so that *all* creatures will flourish with great abundance and diversity.

SABBATH: The Sabbath Principle sets behavioural limits before harsh biological and physical limits are reached, thereby allowing for the restoration and flourishing of life.

asked why, he responds that "the sabbath is made for the land and not the land for the sabbath" (roughly paraphrasing Jesus in Mark 2:27) adding, "that is what my land needs." Thus, for this farmer, the Sabbath Principle, fully applied, would leave some land resting more often than one in seven years, even giving particularly fragile land rest in perpetuity because "that is what it needs."

Not only does the Sabbath Principle protect the land from relentless exploitation, it also serves to set moral limits prior to reaching biological and physical limits. If this law were to be practiced worldwide, one-seventh or more of the land would be at rest each year. Surely that practice would benefit biodiversity, particularly the "unseen" flora and fauna of the soil. When one hears that "economic necessity" requires pressing oneself, other creatures, or the land continuously (7 days a week, 24 hours per day or 7 years upon 7 years), then the limit provided by the sabbath already is exceeded. The sabbath provides a buffer between reasonable self-limitation and a compelling crisis. Observing the sabbath for the land thus eliminates much of the argument about how many people can the Earth support, and other similar questions. If people argue that they *must* violate the sabbath in order to survive, they simultaneously announce that the limit has been reached or exceeded.

The Sabbath Principle thus allows people to make use of the land and its creatures, but not beyond the point of wholesome sustainability. It also sets behavioural limits before harsh biological and physical limits are reached, thereby allowing for the restoration and flourishing of life.

CONCLUSION

Earthkeeping, Fruitfulness, Sabbath — these are the three leading biblical principles for the care of Creation. Thus, Christians and other People of the Book have within their system of belief the ethical capacity and direction for sustaining life on Earth with all of its flourishing biodiversity. Because the People of the Book understand that God is the author both of the biosphere and the Bible, ecological science and biblical ethics become intertwined. Thus, the People of the Book can and should be inspired to learn of their Creator both from the world and from the word. The consequence can be a belief system of remarkable integrity that incorporates both moral behaviour and ecology.

Whatever one's beliefs, however, the teachings of this ancient book, coupled with modern scientific knowledge of the biosphere, provide humankind with a new source of hope. It is the hope that ethical and biospheric integrity can be achieved and the Earth and all its species will flourish.

BIBLIOGRAPHY

Bakken, Peter W., Joan G. Engel and **J. Ronald Engel.** 1995. Ecology, justice, and Christian faith: A critical guide to the literature. Westport, CT: Greenwood Press. 228 pp.

DeWitt, Calvin B. 1995. Ecology and ethics: Relation of religious belief to ecological practice in the biblical tradition. *Biodiversity and Conservation* 4: 838–848.

DeWitt, Calvin B. (rédacteur). 1995. L'Environnement et le chrétien : pistes de réflexion tirées des écritures. Québec: La Clairière. 150 pp.

DeWitt, Calvin B. 1994. Earth-wise: A biblical response to environmental issues. Grand Rapids MI: CRC Publications. 86 pp.

Granberg-Michaelson, Wesley (ed). 1987. Tending the Garden: Essays on the Gospel and the Earth. Grand Rapids MI: Eerdmans. 150 pp.

Oelschlaeger, Max. 1994. Caring for creation: An ecumenical approach to the environmental crisis. New Haven, CT: Yale University Press. 285 pp.

Prance, Ghillean T. and **Calvin B. DeWitt** (eds). 1992. Missionary Earthkeeping. Macon, GA: Mercer University Press.

Reumann, John. 1992. Stewardship and the economy of God. Grand Rapids, MI: Eerdmans. 157 pp.

Union of Concerned Scientists. 1996. *Keeping the Earth: Religious and scientific perspectives on the environment.* (videotape). Cambridge, MA.

Wilkinson, Loren. (ed). 1991. Earthkeeping in the nineties: Stewardship of creation. Grand Rapids, MI: Eerdmans Publishing Co. 381 pp.

Impressions of the Amazon at age 12

Don Chao

Don Chao is the son of a fellow ichthyologist working in Brazil, and each year he travels to Brazil to spend the summer with his father. In 1994 I asked him to record some of his impressions of Brazil and more specifically, the Amazon, for the readers of Global biodiversity. *His descriptions remind us of what it is that all of us are trying to understand and preserve — namely, the richness of biodiversity and natural landscapes. I am sure that other readers have similar firsthand experiences to share and invite you to send your impressions to us for possible publication. [D.E.M.]*

IMPRESSIONS FROM THE SKY

I arrived in the Amazon during the day. The scene from my airplane window was filled with different shades of green for as far as the eye could see. When I looked closer, I saw the Rio Negro flowing through the green just as water spreads on the pavement. The water wove through the forest forming many islands. Even though you know about the deforestation in the Amazon, there was no sign of it from my window.

IMPRESSIONS FROM WITHIN THE FOREST

When you walk into the rain forest, it's like another world. It turns dark and even more humid than it already is. It smells like very fresh, humid air, but not like dew. It's weird — you walk for a while and it turns cool and you feel refreshed and then it becomes hot again. As you walk along, you see many different kinds of trees and bushes. If you are 15 feet away from someone, you won't be able to see them. And there is always a "there is someone watching you" feeling.

There are many different kinds of birds and they all make funny sounds. If you're lucky, you'll get to see a macaw perching way up in the trees. They are really pretty.

You can hear and sometimes see monkeys. They make squeaky noises and lots of other noises, too. It's hard to see the monkeys; usually, I just see the branches moving. Maybe they're hard to see because I don't wear my glasses in the jungle!

Plants

There are many kinds of plants in the forest. I will tell you the ones that I know. There is a water vine (*Dileniaceae* spp.) that is thick like a small tree and hangs down from a humongus tree. It doesn't wind

Don Chao (left) and a tourist visiting from Indiana go on a jungle walk. (Photo by Ning Labbish Chao)

Don Chao, 191 Davis Avenue, Brookline, Massachusetts, USA 02146

around the tree. Instead it branches off from the tree. There are many branches on the vine. To get water, you cut the bottom off with a machete. (Machetes are what people use in the rainforest. They are really sharp, so sharp you could shave with them.) After you have cut the bottom off, you quickly cut a little farther up as well. If you take too long, the water will go to the top of the vine. One person blows on one side of the cut and the other person puts their mouth on the other side. Voila! Water comes out. It tastes pretty good; like water, with a little woody taste. You are not supposed to take too much of it, because the vines are for people that get lost. If you drink it all, there won't be any left for the lost people.

Nathaniel Howland and Junior are canoeing on Rio Cueras, a tributary of the Rio Negro. A farm is in the background. (Photo by Don Chao)

There is a tree called the castanha or Brazil nut tree (Family Lecythidaceae, *Bertholletia excelsa*). They are really, really tall. The outer part of the tree feels pretty smooth with some bumps in it. The trunks are thick and there are no branches until the top of the tree. The branches are thick and strong and seem to be clustered. The tree has ball-shaped pods with Brazil nuts inside. The pods are very hard. I tried breaking a pod open with a hammer, but it didn't work. The way to do it is to chop the top of the pod with a machete. Then the pod sticks to the machete, and you keep pounding and pounding it until the machete cuts through. When you look in the pod, the nuts are lined up on the sides — as in an orange when you peel it. When you take the nut out, there's another hard covering around it. Then — this part takes experience — you chop off the shell with the machete. You have to be careful so you won't cut off your finger. The inside is nice and white. It's moist and a little soft and tastes really good. However, I think it tastes better toasted — it's more crunchy.

There is another tree called pecunha. Like the castanha, this tree has no branches until the very top. I think I know why the branches are at the top. That's where the sun is. Well, what you use from the pecunha tree are the fibres to make a climbing rope. To peel the fibres off the tree, you first stick the machete into the tree sideways. Then you hold both sides of the machete and pull down a strip of the tree. The strip feels sticky and stringy and has tons of fibres that are long and thin. You twist the strip to strengthen the fibres and then tie it so it becomes a ring. This is the interesting part. You find a tree that is about as wide as a piece of typing paper (20 cm), put the ring around your feet, and then jump on the tree as if you were going to climb it. You squeeze your feet around the tree and pull up with your arms, then squeeze your feet together again. When you squeeze the tree with your feet, you can let go with your hands and not fall. Kids in other parts of the world could try this at home with a rope. It is cool.

Here Nathaniel Howland, Don Chao, and Junior are heading towards the Indian village to give them a watergun. (Photo by Ning Labbish Chao)

Don Chao in a dugout Indian canoe. Very tippy!
(Photo by Ning Labbish Chao)

IMPRESSIONS ON THE RIVER

The Amazon from the river is very different than from inside the rainforest. I usually go on the river with a motor boat, canoe, or kayak. I think kayaking and canoeing are the most interesting ways to travel short distances along the riverbank. It is amazing how quiet the river is during the day.

Almost every day there is a storm that comes to the Amazon River and lasts about 15 minutes. The air becomes cooler as dark rain clouds block the sun's rays. The calm river becomes a stormy sea. Waves cover the rivers and wind sways the trees. Out of nowhere pours a big sheet of rain. I can see a distinct line between where it's dry and where it's raining. This is my favourite time to kayak. Rain comes down so hard that it feels as if my face is being cut. I try to get my kayak to literally jump the waves. Just when it feels as if the waves are increasing in height, the rain, the clouds, and the wind disappear. It's amazing. It happens so fast. After the sun comes out, the sky is crystal clear and usually there is a beautiful rainbow stretching across the sky. I can see both ends of the rainbow. This is cool. In the United States, I hardly ever see something like this.

To swim or not to swim?

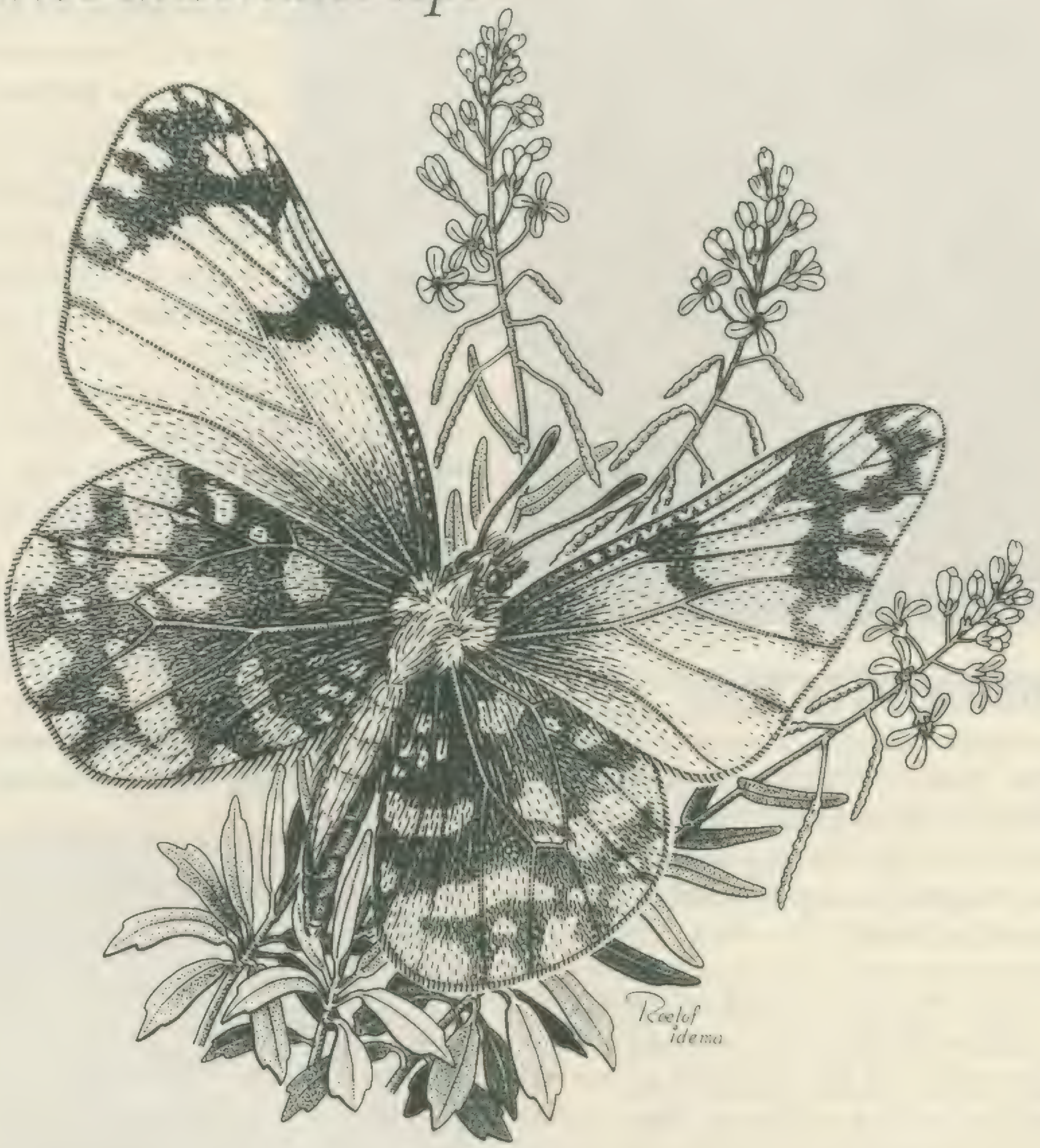
Nathaniel, my friend from Boston, and I stayed at the Apurissawa Jungle Lodge for 21 days. It is a vacation place for people who want to get away from civilization, and the owner is a good friend of my father's. The lodge is a floating wooden hotel held afloat by big tree trunks. Water surrounds all side of the lodge so in the morning you can jump straight into the nice cool water.

One day we canoed up the river to visit the Indians. On the way we tipped our canoe and had lots of fun swimming and trying to breathe air under the canoe. When we got to land, one of the Indian grandmothers called me. She said she thought a big snake had eaten us. She was worried because one of her husband's friends had died where we had been playing. She said a snake got him. Señor Leandro, the caretaker of the lodge, also told me that he has seen big snakes come up to breath air right beside the lodge, and his wife Dona Isabella told me that once she saw the glowing eyes of a caiman right beside the lodge at night. She told her son to throw a log at the caiman and it disappeared. These stories could be a lie or the truth. It's up to you to decide. Nathaniel didn't believe them. But ever since, I have been hesitant about going into the water at night or near trees or logs while swimming in the water.

10 THINGS I THINK KIDS CAN DO TO SAVE THE AMAZON

1. Ask where the meat in your local fast-food restaurant comes from. If it's from the Amazon, go to another restaurant.
2. Do not ask for protected animals from the Amazon as pets.
3. Do not ask for a mahogany toy.
4. Recycle so that there won't be too much pollution to make Amazon hotter.
5. Be aware of what's going on in the Amazon and spread the word.
6. Ask your parents to buy products that will give money to help the Amazon.
7. Read and learn about the Amazon. Maybe when you're older, you will want to join the efforts to save the Amazon.
8. Report people who have illegal items from the Amazon.
9. Ask for aquarium fish from the Amazon to help this business of the local people. Then they won't have to cut down trees to survive.
10. Do not ask for souvenirs made from animal parts from the Amazon.

Large marble butterfly *Euchloe ausonides ssp.*



Special thanks to Jon Shepard.

Euchloe ausonides ssp. is an undescribed subspecies of a wideranging western species of the Large Marble, family Pieridae. This subspecies was endemic to southern British Columbia and is known from only 13 museum specimens. The last specimen was collected on Gabriola Island in 1908. This subspecies is almost certainly extinct, although it is faintly possible that a population may exist on one of the Gulf of Georgia Islands. Other extant subspecies of *Euchloe ausonides* are widespread in Western North America. This particular subspecies is thought to have fed on crucifers (mustard family) of the genera *Arabis* and *Sisymbrium* in Garry Oak (*Quercus garryana* Douglas) woodland habitat, which was formerly found on southern Vancouver Island and adjacent islands. This original habitat has been highly modified from its original floristic associations due to sheep grazing and the introduction of alien species such as Scotch Broom (*Cytisus scoparius*). In addition, urbanization and industrialization has significantly decreased the extent of this habitat.

Loss of biodiversity has occurred at both the genetic and ecosystem levels. The unique combination of genes that constituted this subspecies of Large Marble is probably gone forever. The original composition of Garry Oak woodlands is now irrevocably altered. The eventual description and naming of the Large Marble subspecies will enhance scientific knowledge of biodiversity — but sadly, of lost biodiversity.

Limitations of endangered species lists

Lee Harding

Much conservation energy is currently spent on identifying species at risk, one by one, and launching individual recovery programs. Lesser-known species tend to be ignored. With rapid increases in the numbers of endangered species and ignorance about the status of others, we must ask whether or not there is a better approach. Harding's views provide useful input into the conservation process. [D.E.M.]

THE PROBLEM

Concern that publication of endangered species lists puts a limit on the number of taxa recognized as being under the threat of extinction has been expressed by Diamond (1987), Mace (1994), and others. This is because only described species can be listed, and once a list exists, conservationists and survey efforts focus especially on those species. Little attention is paid to taxa that are not listed, and their plight worsens. For example, *On the Brink: Endangered Species in Canada* (Burnett et al., 1989), *The State of Canada's Environment* (Environment Canada, 1991) and *State of the Environment Report for British Columbia* (B.C. Ministry of Environment et al., 1993) all contained statements about the numbers of species at risk as absolutes, leaving the clear, erroneous impression that all species were known, and that their conservation status had been assessed.

Canada's Biodiversity (Mosquin et al. 1995) is one the of the few publications that tackles the question of how many species there really are, including those already named, and estimates of those yet to be discovered, named, and classified. The authors try to overcome the ignorance of rarity in poorly studied groups by applying the percentage of species at risk in known taxonomic groups to the groups' estimated total number of species. This suggests several thousand species at risk in Canada instead of the less than 300 listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

In 1988 the Canadian Council of Wildlife Ministers established a federal strategy for recovery of endangered wildlife (RENEW), working from the official COSEWIC list. This is an important component of the Canadian Biodiversity Strategy (Environment Canada, 1995). Because COSEWIC was formed by the country's provincial and federal directors of wildlife management, it has always been limited by the mandates of these agencies. One does not have to go very far back in the history of wildlife management in Canada, and elsewhere, to a time when "wildlife" was game, everything else that walked, flew, swam, or crawled was "vermin," and agencies paid a bounty for "varmints" such as wolves and kit foxes (Leopold, 1933) — species that now grace endangered species lists.

Given such beginnings, the group has made great strides in conserving biodiversity. We saved the whooping crane. Peregrine falcons again stoop over the marshes. Gray wolves now howl from ranges where their voices had been long absent. Grizzly bears safely prowl mountains, and one whole watershed in British Columbia has been preserved for their protection. These charismatic species are icons of conservation that link the public with the politicians. Doubtless many more humble species have been saved because they were lucky enough to share the shadows of the species superstars. But what of the species that do not even have a name, let alone a popular following?

COSEWIC: PART OF THE SOLUTION

COSEWIC's strengths are in its scientific rigour and its openness of process. Its rigour ensures that listing, with commensurate expenditure of public funds for recovery programs, is limited to species that really are endangered.

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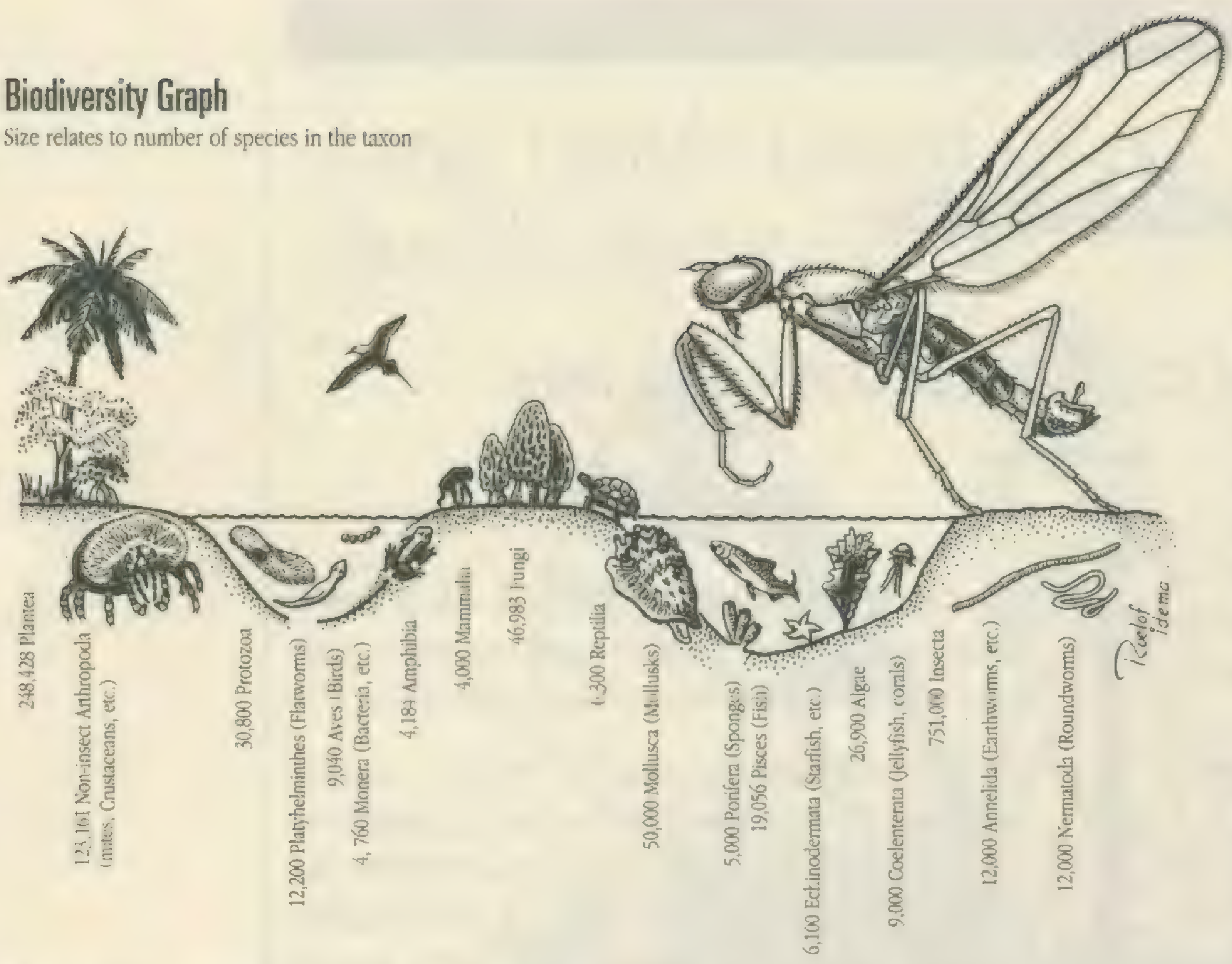
Biodiversity Graph

Size relates to number of species in the taxon

248,428 Plantea
123,161 Non-insect Arthropoda (mites, Crustaceans, etc.)
30,800 Protozoa
12,200 Platyhelminthes (Flatworms)
9,040 Aves (Birds)
4, 760 Monera (Bacteria, etc.)
4,184 Amphibia
4,000 Mammalia
46,983 Fungi
6,300 Reptilia
50,000 Mollusca (Mollusks)
5,000 Porifera (Sponges)
19,056 Pisces (Fish)
6,100 Echinodermata (Starfish, etc.)
26,900 Algae
9,000 Coelenterata (Jellyfish, corals)
751,000 Insecta
12,000 Annelida (Earthworms, etc.)
12,000 Nematoda (Roundworms)
Roelof Idema

The Biodiversity Graph gives an indication of the number of described species in each of the major taxa, totally nearly 1.4 million. Note that the size of the image relates to the known number of species in the taxon. Then consider how many species are being ignored by the current listing process of COSEWIC, which until recently only considered vertebrates and vascular plants. In the last couple of years, COSEWIC has expanded its mandate to include non-vascular plants and some invertebrates (butterflies, moths, and molluscs).

The openness of its process admits views and expertise from outside of government and ensures a degree of objectivity. But endangered species lists as exemplified by COSEWIC do have some limitations as a basis for conservation of biodiversity.

First, COSEWIC originally addressed only vertebrates and later expanded the listing process to include vascular plants. COSEWIC has recently considered how or whether to include other taxa such as non-vascular plants and invertebrates, and non-vascular plants are now being addressed by specialist groups set up within COSEWIC's plant subcommittee. In the invertebrate category, COSEWIC has decided to classify only lepideropterans and freshwater molluscs for the time being in association with the Canadian Nature Federation's Endangered Plants and Invertebrates of Canada (EPIC) program (Environment Canada, 1995). EPIC's program, however, has already been critiqued by Aniskowicz (1995). Some other parallel process is still needed to deal with the many other taxa that will remain outside of COSEWIC's purview.

A second limitation is derived from one of COSEWIC's strengths: its scientific rigour, and the fact that reviews are done often by experts within and outside of agencies largely on a volunteer or "as-time-permits" basis. This combination can make for a slow process! One often suspects that the rate of species endangerment exceeds the pace of determining conservation status, although these rates are difficult to measure.

Of course, specialists can only assess conservation status if inventory data are available and taxonomic status is known, and so, the lack of biosystematic information is a third, serious limitation of this process in terms of contributing to a biodiversity conservation strategy (Miller and Scudder, 1994). Another serious concern about COSEWIC's categorization is that they have no legally binding effect to protect species or their habitats, unlike the EPA in the United States. The proposed Canada *Endangered Species Protection Act* (CESPA) will provide some legal protection for listed species.

A LOOK AT BRITISH COLUMBIA

The limitations of the endangered species listing process are illustrated by the differing estimates of the number of species in various conservation status categories. COSEWIC currently lists 4 species or subspecies of extinct or extirpated plants and vertebrate animals from British Columbia, and 21 threatened or endangered. However, Harding and McCullum (1994) counted 11 vertebrate and 9 plant (4 vascular) species or subspecies, as well as 3 invertebrates, that have become extinct or extirpated from British Columbia (although three have since been re-introduced) (see Table 1). The authors of other chapters in *Biodiversity in British Columbia: Our Changing Environment* believe that at least 800 species of terrestrial and freshwater invertebrates (Scudder, 1994b), perhaps 15 species of benthic marine algae, 5 amphibians, 26 fish, 63 bryophytes, 124 vascular plants, and several bird species are threatened or endangered, and many more (including over 600 vascular plants) are thought to be rare or vulnerable. The B.C. Red List of threatened and endangered wildlife is another example of the diversity of classification systems, listing 151 species and subspecies of vertebrates, not including fish, marine mammals, and exotic species (Harcombe, 1994). Therefore, between the species *thought* to be endangered by specialists and those *agreed* to be endangered by official committees, the gulf is very wide. The Canadian biodiversity strategy (Mosquin et al, 1995) notes the large number of species yet to be named, or whose status is not yet known. How many of those exist in British Columbia?

Pielou (1995) attempted to tally all the known taxa in British Columbia. A more complete list is given in Table 2;

Table 1. Extinct and extirpated species and subspecies in British Columbia

MAMMALS	Wood Bison,[1] *Bison bison athabascae*
	Plains Bison,[2] *Bison bison bison*
	Dawson Caribou,[3] *Rangifer tarandus dawsoni*
	Sea Otter,[2] *Enhydra lutris*
	White-tailed Jackrabbit, *Lepus townsendii*
BIRDS	Passenger Pigeon,[3] *Ectopistes migratorius*
	Sage Grouse, *Centrocercus urophasianus*
	Burrowing Owl,[2] *Athene cunicularia*
	Yellow-billed cuckoo, *Coccyzus americanua*
FISH	Dragon lake whitefish,[3] *Coregonus sp.*
REPTILES	Short-horned Lizard, *Phrynosoma douglassii*
PLANTS	Verbena, *Abronia umbellata acutalata*
	Nicotiana, *Nicotiana attenuata*
	Buttercup, *Ranunculus lobbii*
	Common Downingia, *Downingia elegans*
	moss, *Pseudephemerum nitidum*
	moss, *Micromitrium tenerum*
	moss, *Discelium nudum*
	moss, *Fissidens pauperculus*
	hornwort, *Phaeoceros hallii*
INVERTEBRATES	Viceroy butterfly, *Basilarchia archippus*
	Perdiccas subspecies of Chalcedon checkerspot butterfly, *Euphydryas chalcedona peridiccas*
	Vancouver Island subspecies of Large marble butterfly,[3] *Euchloe ausonides ssp.*

COSEWIC currently lists 4 species or subspecies of extinct or extirpated species. Note how this compares to Harding and McCullum's list (1994) shown in Table 1.

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[1] Some recent sightings near NWT

[2] Since re-introduced from non-indigenous populations

[3] Extinct

Table 2. Number of known and estimated species in British Columbia

TAXON	KNOWN	ESTIMATED
Viruses	?	?
Monera (bacteria and cyanobacteria)	>225 (marine only)	> (225)[1]
Protista		
terrestrial	? (250 in soils)	? (>250 in soils)[2]
marine	>1,017	> (>1,017)[1]
Algae		
marine macroalgae	639	? (>639)[3]
aquatic algae	2,112	? (>2,112)[4]
Fungi (all groups)	? (100 + marine[1])	> 10,000[5]
Macrofungi	~1,250	> 2,000[6]
Lichens	~1,300	2,000[7]
Plantae		
Bryophyta (mosses, liverworts)	~940	? (>940)[8]
Filicophyta (ferns)	74	74[9]
Vascular plants	~2,854	2,854[9]
Animalia		
Rotifera	50 (terrestrial soil)	(>50)[2]
Nematoda	500 (terrestrial soil)	(>500)[2]
Gastropoda	100 (terrestrial soil)	(>100)[2]
Annelida	125 (terrestrial soil)	(>125)[2]
Arthropoda	~25,000	45,000[10]
Marine invertebrates (all taxa)	~4,500	7,150[11]
Vertebrata	1,088	1,088[12]
TOTALS:	~42,124	>76,124

[1] Austin, 1985 and 1992; [2] Marshall, 1993; [3] Hawkes, 1994; [4] Stein and Borden, 1975 (includes 2,037 "subgenera" plus 75 genera for which species are unknown); [5] Pojar, 1993; [6] Redhead, 1994; [7] Goward, 1994 and T. Goward, In. Lit., May 5, 1995; [8] Schofield, 1994; [9] Douglas et al., 1994; [10] Scudder, 1994a; [11] Lambert, 1994 and P. Lambert, In. Lit. May 3, 1995; [12] BC Ministry of Environment, Land and Parks.

this list, too, will no doubt need to be revised soon, as more information comes in. About 42,124 species are known in British Columbia. This apparently precise number is only approximate because even the experts are hard-pressed to provide exact counts, owing to taxonomic uncertainties and the difficulties of actually compiling lists.

Being certain and exact often involves visiting multiple reference collection sites and consulting colleagues for unpublished records — this is time-consuming and expensive. In addition, taxonomists (and natural history collections) are at risk themselves, overworked, and many groups no longer have the needed expertise. In today's world of downsizing the experts have retired or passed away and not been replaced. Finally, there are gaps in information in certain geographic areas due to the lack of biological surveys and natural history collections. For example, due to the lack of surveys, records on spot-on-spot distribution maps are sparse in northern B.C. and certain parts of the coast.

In B.C., all regularly occurring vertebrate taxa (except exotics, fish, and marine mammals other than the sea otter) have been evaluated and ranked as to their conservation status (Harper et al., 1994). However, these 850 species and subspecies represent only 0.2% of the known native species in all taxa, and about 0.1% of the known and expected unknown native species (Table 2). At the federal level, 334 species and subspecies of vertebrates and vascular plants in the country have been assessed (COSEWIC, 1994), or 0.2% of the 139,486 known and unknown non-viral species in Canada (Mosquin et al., 1995).

Moreover, new species are being discovered at a rapid rate, increasing not only those we know, but the estimated number of centinelan species — i.e., those yet to be discovered (Wilson, 1992). For example, investigators studying insects in temperate rainforests (Winchester and Rinj, in press) and in the dry grasslands of British Columbia (British Columbia Ministry of Environment, Lands and Parks, 1995) have discovered such a high proportion of species new to the province in relation to those already known that the estimated totals have been revised upwards. Species new to science are being added each year (Scudder, pers. comm.). Likewise, approximately 120 new species of lichens were recorded in British Columbia in August, 1993 in connection with field excursions sponsored by the Fifth International Mycological Congress in Vancouver (Goward, pers. comm.), again resulting in upward revisions of both the known and estimated unknown numbers. While there is much we don't know about the number of species that live in British Columbia, one thing we do know is that only a small proportion of them have even been discovered, let alone assessed as to their conservation status.

Endangered species specialists and officials are well aware of the gaps in their procedures and are moving to fill them. COSEWIC, as noted above, began listing wildlife and later expanded to include other taxa, and has modified its definitions of conservation status to be more inclusive. Similarly, the BC Environment Ministry at first listed only wildlife, but has now adopted the international Conservation Data Centre system of classifying conservation status, which includes not only all taxa, but may also include rare ecosystems or habitat elements (Harcombe et. al., 1994). However, even this broad scope cannot hope to cope with the full range of biodiversity, considering the estimated number of undiscovered species.

SOLUTIONS

First, communications regarding species at risk should include reference to the limitations of the process, such as:

- taxa not included in the assessment;
- the backlog of species thought to be endangered, but for which no formal assessment of conservation status has been completed;
- taxonomic groups for which expectations for new species discoveries are high; and

- taxonomic groups with no recent revision or lacking living taxonomic expertise.

Second, while protection of individual endangered species is important and necessary, biodiversity strategies must be founded on conservation of ecosystems of sufficient diversity, extent, and connectivity to ensure that all species, including unknown species and those of uncertain conservation status, are protected.

Finally, a biodiversity strategy should address the current level of biosystematic and taxonomic expertise, infrastructure (herbaria, reference collections, botanical gardens), and survey efforts.

ACKNOWLEDGEMENTS

Art Martell, Geoff Scudder, Neville Winchester, Cris Guppy, Wilf Schofield, Trevor Goward and Ted Mosquin reviewed the manuscript. Bill Austin and Phil Lambert provided unpublished data on marine invertebrates.

REFERENCES

Aniskowicz, B.T. 1995. The neglected majority continue to struggle for recognition. *Global biodiversity* 5(3): 4–7.

Austin, W. 1985. An annotated checklist of marine invertebrates in the cold temperate Northeast Pacific. Khoyatan Marine Laboratory, Cowichan Bay, B.C. 682 pp.

Austin, W. 1992. Marine biodiversity in British Columbia. Khoyatan Marine Laboratory, Cowichan Bay, B.C.

British Columbia Ministry of Environment, Lands and Parks and **Environment Canada.** 1993. State of the Environment Report for British Columbia. Government of British Columbia, Victoria. 127 pp.

British Columbia Ministry of Environment, Lands and Parks. 1995. Rare invertebrates of the South Okanagan (brochure).

Burnett, J.A., C.T.D. Dauphin J. Jr., S.H. McCrindle and **T. Mosquin.** 1989. On the brink: endangered species in Canada. SOE Reporting Branch, Environment Canada, Ottawa.

Diamond, J.M. 1987. Extant unless proven extinct? Or extinct unless proven extant? *Conservation Biology* 1(1): 77–79.

Douglas, G.W., G.B. Straley and **D. Meidinger.** 1994. The vascular plants of British Columbia. BC Ministry of Forests.

Environment Canada. 1991. The State of Canada's Environment. Ottawa.

Environment Canada. 1995. *The Canadian Endangered Species Protection Act:* A legislative proposal. Canadian Wildlife Service.

Goward, T. 1994. Rare and endangered lichens in British Columbia *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 77–80.

Harcombe, A., B. Harper, S. Cannings, D. Fraser and **W.T. Monro.** 1994. Terms of endangerment *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 11–28.

Hawkes, M. 1994. Benthic marine algal flora (seaweeds) of British Columbia *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 113–118.

Lambert, P. 1994. Biodiversity of marine invertebrates in British Columbia *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 57–70.

Leopold, A. 1933. Game management. Charles Scribner's Sons, New York: 481.

Mace, G.M. 1994. An investigation into methods for categorizing the conservation status of species *in* P.J. Edwards, R.M. May and N.R. Webb (eds.). Large scale ecology and conservation biology. Blackwell Scientific Publications, Oxford: 293–312.

Marshall, V.G. 1993. Sustainable forestry and soil fauna diversity *in* M.A. Fenger, E.H. Miller, J.F. Johnson and E.J.R. Williams (eds.). Our living legacy. Royal British Columbia Museum: 239–248.

Miller, E. and **G.G.E. Scudder.** 1994. A rose by any other name *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 29–42.

Mosquin, T., P.G. Whiting and **D.E. McAllister.** 1995. Canada's biodiversity. Canadian Museum of Nature, Ottawa, Ontario.

Pielou, E.C. 1995. The what, why and how of biodiversity. *BioLine* 12(1): 12–14.

Pojar, J. 1993. Terrestrial diversity of British Columbia *in* M.A. Fenger, E.H. Miller, J.F. Johnson and E.J.R. Williams (eds.). Our living legacy. Royal British Columbia Museum: 177–190.

Redhead, S. 1994. Macrofungi of British Columbia *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 81–90.

Schofield, W.B. 1994. Rare and endangered bryophytes in British Columbia Columbia *in* L.E. Harding and E. McCullum (eds.). Biodiversity: Our changing environment. Environment Canada, Delta, B.C.: 71–76.

Scudder, G.G.E. 1994a. Terrestrial and freshwater invertebrates of British Columbia: species status and priorities for inventory. Ministry of Environment, Lands and Parks.

Scudder, G.G.E. 1994b. An annotated systematic list of the potentially rare and endangered freshwater and terrestrial invertebrtes in British Columbia. *Entomol. Soc. Brit. Columbia*, Occasional Paper 2, 92 pp.

Stein, J. and **C.A. Borden.** 1975. Checklist of freshwater algae of British Columbia. *Syesis* 12: 3–78.

Wilson, E.O. 1992. The diversity of life. Belknap Press of Harvard Univ. Press, Cambridge, MA.

Winchester, N.N. and **R.A. Rinj.** In press. Centinel extinctions: Extirpation of northern temperate old-growth rainforest arthropod communities.

Initiatives and successes

✓ International Summer School on Biodiversity & Systematics

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The International Summer School on Biodiversity and Systematics is an initiative of the Canadian Museum of Nature (CMN) and its partner, Queen's University in Kingston, Ontario. About to offer its second year of classes, the summer school is a response to the critical need for increased training opportunities in systematics. This need was articulated by the staff and management of CMN and highlighted in the 1992 report of the Task Force on Canadian Biosystematics. Other organizations, such as the Canadian Society of Zoologists and the Canadian government's Federal Biosystematics Group, have also identified the urgent nature of providing educational opportunities for systematists. The inaugural summer school took place in June and July 1996, and a brief report was included in Global Biodiversity 6(3): 34. This year the school will run from 9 July through 7 August, and will be based in Ottawa (Canadian Museum of Nature and University of Ottawa) and Kingston (Queen's University) and at the Queen's University Biological Station on Lake Opinicon, Ontario.

The aim of the course is to provide participants with an introduction to the key issues and concepts at the heart of the study of biodiversity and systematics. This exploration is not be limited to ideas contained within the biological sciences (i.e. the number, distribution, classification, and function of the vast array of organisms) but will also explicitly articulate the interplay between academic inquiry in these areas and the wide variety of human activities and values. The intent is to offer students an understanding and appreciation for how the current assemblage of life arose, is maintained, and might be accommodated in the future. In addition to its biological content, the course will also challenge participants to view the phenomenon of nature from social, moral, political, economic and cultural perspectives

After a thorough evaluation of last year's curriculum by students, faculty and school staff, it was clear that improvements could be made in both structure and content. We have addressed those issues and have re-worked the course to give it a better orientation and a tighter focus. To facilitate the participation of professionals from corporate, government and other sectors, who are likely more time constrained than university students, the course will be divided into two modules:

- Module I (5 days) comprises a general overview of the diversity of life on earth; its form, function, classification, study, and the ways in which a variety of human concerns impinge upon it. For both biologists and non-biologists this module will offer a chance to view the "big picture" of biodiversity and systematics; a syncretic exercise designed to allow perspective on an immense and complex set of issues.

- Module II (3 weeks) is intended for anyone who has a deeper interest in biodiversity and systematics, primarily biologists or others continuing on from Module I. It includes an overview of the major divisions of the living world, coupled with hands-on field studies and exercises in identification and contextual study, as well as quantitative methods in species diversity estimation. Also a core section of instruction on the theory underlying biodiversity and systematics will be presented along with lab exercises in molecular genetics and phylogenetic inference and software usage. The course concludes with several days of more in-depth studies of economics, law, government policy, human development, and conservation issues relating to biodiversity and systematics.

One of the most exciting aspects of the school is its international character. Last year participants from five countries interacted with instructors from four countries. Added to this international perspective was the diverse array of backgrounds from academia, industry, government, and non-governmental organizations and interest groups. This year the design of the school further capitalizes on the mix of backgrounds and expertise to facilitate formal and informal discussions, and group and individual projects. The access by participants to a diversity of expertise and a wide variety of facilities is unprecedented. The facilities include the worldwide collections of the CMN, the laboratories of two universities, and the Queen's Biological Field Station, and the expertise includes a faculty drawn from museum, university, government, and private sector experts..

Space is limited to 25 participants and applications will close on June 15. Additional information on The International Summer School on Biodiversity and Systematics can be found through World Wide Web links through the Canadian Museum of Nature <http://www.nature.ca/english/biodive.htm>, Queen's University <http://www.biology.queensu.ca/> or at its own home page <http://biology.queensu.ca/~biodiv>. Or please contact the director of the school, Dr. Steve Lougheed (see address above). (Special thanks to Stephen L. Cumbaa, Research Scientist, Paleobiology, CMN for writing this article.)

✓ A Charter for Earth: A code of conduct for humans in regard to nature

CONTACT: Earth Council, Apdo. 2323-1002, San José, COSTA RICA, Tel: (506) 256-1611, Fax: (506) 255-2197, E-mail: <echarter@terra.ecouncil.ac.cr>, Web site: <http://www.ecouncil.ac.cr>

In *Global biodiversity* 4(1): 2–3, we featured a profile of the Earth Council. In the last three years, the Council has been busy — to say the least. And in 1996, the Council was responsible for one of the year's most inspiring events, which took place at the World Conservation Congress in Montreal, October 1996. Here, Maximo Kalaw, President of the Earth Council, delivered a visionary statement on the new Earth Charter under development.

Declarations like the Magna Charta and the Universal Declaration of Human Rights have provided guiding lights for humanity in their relationships with one another and inspiring principles for justice in local, national, and international courts. As we approach the 21st century and the planet's natural areas shrink, a greater need is being felt for a set of guiding principles that will help guide the way humans interact with nature. Kalaw's speech outlines how an Earth Charter would achieve this goal.

The Earth Charter is envisioned to serve as a universal code of conduct based on fundamental values and principles that will guide people and nations towards sustainable living. Following an open consultation process it is hoped that the Earth Charter will be approved by the year 2000. This might be a two-step process, with governments first signing acceptance of the principles on a voluntary basis, and then ratifying those principles of the covenant that they feel they can implement.

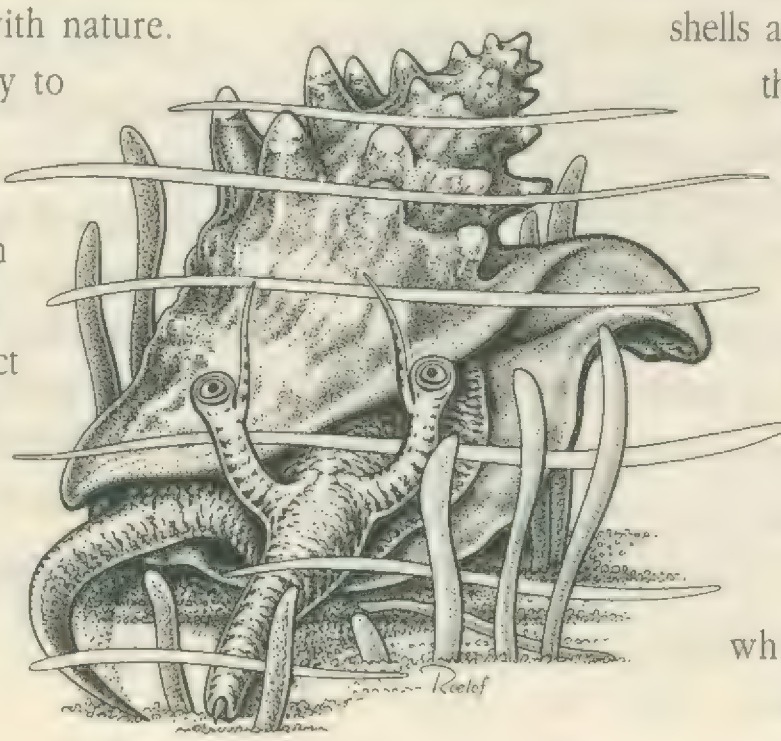
The transition to sustainable development will require basic changes in the values, behaviour and attitudes of government, the private sector, and civil society. Ultimately, sustainability will depend on the decisions that citizens make about the lifestyle they wish to pursue and the degree of intimacy they would like to have with nature for themselves and their children — living in larger and larger areas of concrete and asphalt with only a few small islands of wilderness, or living in natural and developed areas intertwined so that nature becomes a part of everyday life, and so that the natural areas are of sufficient size and diversity to sustain the local and planet-wide support systems.

The consultation process underway includes engaging NGOs, other organizations, and institutions from various sectors that have an impact on sustainable development. This means that the Charter would be based on the values of diverse cultures, religions, sectors, and groups of civil society reflected in the consultative groups. It would provide opportunities for people to make personal and collective commitments to sustainable development, and develop a broad public ownership of the Earth Charter by participating in the process and thus, raising awareness about sustainable development.

The Earth Charter Commission, with about 20 eminent people, including 5 Regional Co-Chairs (Asia, Europe, Latin America and Caribbean, North America, and Africa) and 9 people on the Earth Charter Management Committee, would help guide the process. The consultation process will be consolidated early in 1997 and the results will be worked into a report to help guide the design and drafting of the Earth Charter. International dialogues on the Charter are expected to continue well beyond 1997, with approval from the United Nations expected before the year 2000.

For more information about the Earth Charter Project and opportunities for involvement, please contact the International Secretariat at the address at the beginning of this article.

It is intended that the Earth Charter be written in clear, concise, inspiring words, so that all will understand it. As such, the Charter will provide a major window of opportunity for this generation to help humankind live in greater harmony with nature. What a superb way to start the next millennium! [Prepared with material from the Earth Charter Project pamphlet by D.E.M.].



A new industry — conch farming

CONTACT: Dr. Chuck Hesse, Caicos Conch Farm, TWI Ltd – PO Box 286, Providenciales, Turks & Caicos Islands, BWI, Tel/Fax: (809) 946-5849

The Queen Conch, *Strombus gigas* (featured on the cover of *Global biodiversity* 6(1)), was once the staple food of the Caribbean, providing a rich supplement of protein, vitamins, and minerals. So rich a food source was the conch that Chinese communities considered it an aphrodisiac and resulting exploitation drove it to the brink of extinction. Even now, the only large remaining Caribbean conch beds, off Cuba, are being commercially dragged — the entire coralline sea bottom being scraped away in the process. The Cuban conch fishers are about to share the distinction of the Canadian cod fishers.

But all is not lost. They will not get "the last one." In the Turks and Caicos Islands in the British West Indies, Dr. Chuck Hesse has devoted two decades of his life and US $7 million of investors' money to develop the world's first commercial conch farm. The Caicos Conch Farm was the first research operation in the world to artificially raise the animals through the microscopic, free-living "veliger" or larval stage. This success has resulted in a current farm population of 1.5 million conch in various stages of development. The giant snail-like gastropods are born, raised, and harvested like terrestrial livestock. To visit the farm, you don snorkel gear, dive, and observe in wonderment as everywhere, conch are grazing like aquatic Holstein, their trunk-like mouths stretching out from under their large pink shells, quietly slurping algal bits from the sand and grass.

Conch-raising will help preserve the coral wilderness and create "farm jobs." From the Caicos Conch Farm, young shells are shipped out to re-stock the Bahamas and the Florida Keys. The shells display beautiful hues of pink mother-of-pearl and are sold for decoration, or made into jewellery. Pink conch pearls are more highly valued than oyster pearls. And the meat! Conch steak is a heavenly treat; healthy old-timers of the Florida Keys who regularly enjoy the food are known as "Conchs." The Islands have a hundred recipes for conch chowder, and the spicy conch fritters and white salad meat are a gourmet's delight. [R. Idema]

Biodiversity news

British Columbia and Nova Scotia get top marks in protecting wilderness

Nova Scotia and British Columbia, two Canadian provinces, were applauded for their achievements in protecting wilderness during 1995–96 when World Wildlife Fund Canada released its annual "Endangered Spaces" Report Card. Based on a set of scientific criteria, both provinces were awarded an "A" for their efforts.

In sharp contrast, Ontario and New Brunswick received an "F" for their failure to make progress towards their goal of completing a representative system of protected areas by the year 2000. Marine efforts, graded for the first time this year, revealed an ongoing lack of attention. The 1996–97 report will be released on April 29th, 1997. To check out the new grades, go to <http://www.wwfcanada.org/spaces/x-004.html>. [From *Working for Wildlife* Summer 1996, pp. 1–2].

ENDANGERED SPACES REPORT CARD

Terrestrial Grades:		
	Federal Government	C
	Yukon	D
	Northwest Territories	D
	British Columbia	A
	Alberta	B
	Saskatchewan	C
	Manitoba	D-
	Ontario	F
	Quebec	C-
	New Brunswick	F
	Nova Scotia	A
	Prince Edward Island	C+
	Newfoundland/Labrador	D
Marine Grades:		
	Federal Government	C
	Pacific Region	C
	Arctic Region	D-
	Atlantic Region	D+
	Great Lakes Region	D

Celebrating the Portuguese centennial of oceanography

In February 1996, an international symposium of marine scientists gathered at the University of Portugal, Cascais to commemorate the centennial of Portuguese oceanography. The three-day observance was opened by the President of the Portuguese Republic and visiting Prince Albert of Monaco, and marked the prowess of the first scientific exploration of the waters of Portugal. This exploration was begun in February 1896 by King Carlos I through an eventful association with the Mediterranean oceanographer, Prince Albert I of Monaco.

On Days two and three of the event, invited participants presented 30 papers; history and marine science, geophysics, and biology were featured in the daily sessions.

In a closing tribute to Portuguese history and the hosts, the convocation acclaimed the recent Portuguese initiative of the International Oceans Commission of UNESCO, which called for observance of a United Nations Year of the Oceans in 1998, when Portugal will be hosting Expo 1998.

The assembled members expressed concern over the developing problems for oceanography and the world's oceans, including regret for existing worldwide behaviour in unwise development and wasteful exploitation. The statement laments the reduced productivity of the oceans, the encroachment on bay, estuary, and shoreline recruitment habitats, the wide pollution and the contamination of global waters, and the decline of species diversity. The members' statement calls for the attention of international, national, and local bodies, as well as the attention of individuals to the future health and well-being of the oceans and their living resources.

A medal was struck for the Centennial and commemorative stamps were issued. A volume on the occasion will be published, with Portugal and its oceanographic associates looking forward to the next 100 years. [Richard Gordon Miller, Forest Institute for Ocean and Mountain Studies, University of Arizona, Tucson, Arizona, USA, Fax: (520) 323-2751].

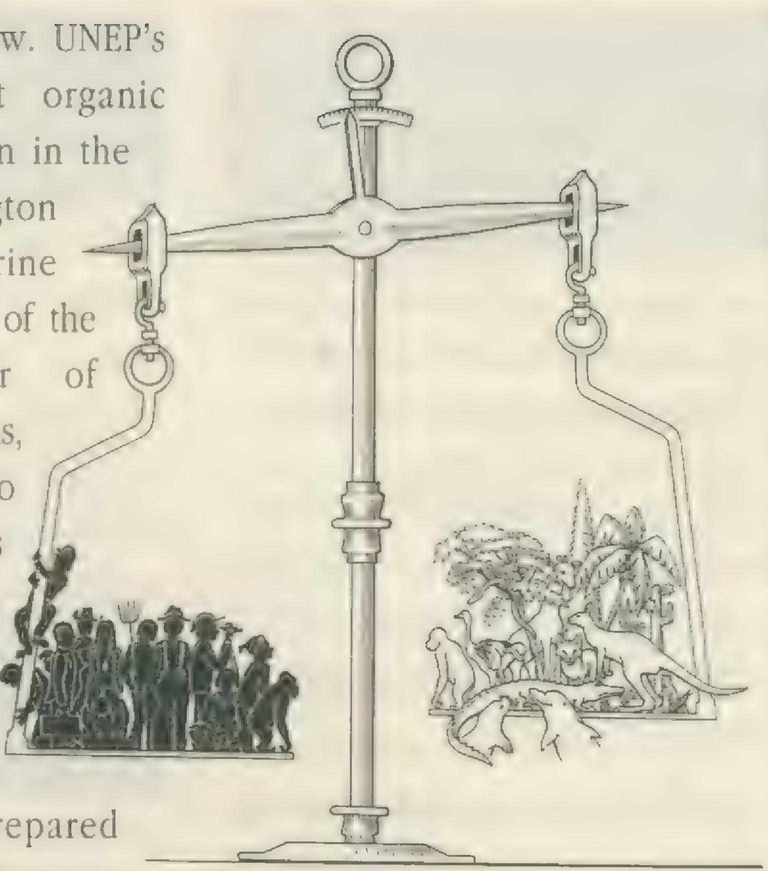
Global hazardous chemicals agreement on its way

Governments from more than 80 countries have made remarkable progress in the development of a legally binding agreement on internationally traded pesticides and hazardous chemicals.

In March 1996, the Intergovernmental Negotiating Committee for an International Legally Binding Instrument for the Application of Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade held its first session in Brussels under the auspices of UNEP and FAO. Here, strong commitment to the negotiation process was demonstrated by the speed with which the session identified potential elements to be included in the PIC Convention. A Working Group also made progress in identifying the chemicals that the Convention should cover.

Africa, Central and Eastern Europe, Latin America, and the Caribbean all stressed the urgent need for technical assistance to implement such a Convention, especially in the development of relevant legislation and chemical management infrastructures. For developing countries and countries with economies in transition, the session considered the interrelationship between economic development and environmental protection critical. The meeting also recognized the need to ensure that industrial chemicals and pesticides are appropriately managed at the global level while contributing to economic growth.

A second negotiating session, led by UNEP and FAO on the PIC Convention was to follow. UNEP's actions on persistent organic pollutants (POPs), taken in the context of the Washington Conference on Marine Pollution as well as that of the International Register of Potentially Toxic Chemicals, will continue to complement the decisions made during this negotiating process. In addition, in April 1996 a meeting of government-designated experts prepared recommendations for the next Governing Council on measures beyond the PIC procedure that may be needed for the sound management of these chemicals. The results of these global efforts will be vital to the protection of human health and the environment from chemical and pesticide hazards. [*Our Planet*, 1996, Volume 8, Number 1].



Population, environment, and Canadian policy

As evidenced in documents and meetings, such as the 1987 Brundtland Commission's *Our Common Future* to the 1995 Cairo Conference, many people recognize that human population growth is one of the root causes of loss of wild ecosystems, biological resources, and ecological services essential to maintaining the planet and humanity. What is Canada's position? A 1996 letter from the Minister for International Cooperation and the Minister responsible for La Francophonie, Pierre S. Pettigrew, provided the following answers.

> Canada's foreign policy statement, *Canada and the World*, states that the Canadian government is committed to allocating 25 per cent of the Official Development Assistance budget to basic human needs, including support to family planning and primary health care. During the past three years, despite fiscal restraints, the Canadian International Development Agency (CIDA) has provided approximately 30 million dollars per year to population programming.
>
> CIDA is currently strengthening its programming in population and reproductive health. The CIDA Strategy for Health — Draft for Discussion has just been released. The document identifies women's health and reproductive health as the priority objective. CIDA is also examining its population programming in line with Canada's commitment at Cairo and Beijing.

Despite Canada's contribution, the international resources to address the environmental consequences of human population growth and encroachment on, or degradation of, wild lands and waters is nevertheless quite inadequate. [D.E.M.].

Canadian environmental philanthropy — Donating your lands for conservation purposes

For years, any land owner in Canada who donated land to an environmental charity faced two roadblocks:

1) If the recreational/farm/forestry lands had *appreciated in value* since acquisition, the donor could face capital gains tax when giving the property away; and

2) The usable tax receipts for the donation were subject to mathematical limits (usually 20% of income) — so that the tax liability (due to "capital gains") could exceed usable receipts, and the donor might be compelled to pay tax in order to give the property away.

Changes in the 1996 Federal Budget about Ecological Gifts, if put into law, may mean one no longer has to pay tax to give property away for conservation purposes. While the changes would totally eliminate the requirement that the donor pay tax in order to give the property away, donors would not be able to use the full fair-market value of their gift as a net tax receipt; instead a significant part of the tax receipt would be used to offset the net tax liability, and the donor would only benefit from the balance. For more information contact Revenue Canada, or request a copy of Marc Denhez's paper for the North American Wetlands Conservation Council (Canada): *The 1995–96 Federal Budgets and Environmental Philanthropy*. [D.E.M.].

Canadian study on Biodiversity Law and Policy now available

For a copy of the full report, please contact Anne Mitchell, Executive Director, CIELAP, 517 College Street, Suite 400, Toronto, Ontario, M6G 4A2, Tel: (416) 923-3529, Fax: (416) 923-5949,: E-mail: <cielap@web.apc.org>.

New Fish Protection Act for British Columbia

In Canada fisheries come under federal jurisdiction, but British Columbia wants to do what it can to protect its salmon and other West Coast fish resources. This new provincial Act will address degradation and destruction of fish habitat through urban, industrial, and agricultural development — an area that the province has control over. The new law will amend a number of existing statues: the *Water Act*, the *Wildlife Act*, the provincial *Fisheries Act*, and the *Municipal Act*. Early in 1997, four workshops on the proposed Fish Protection Act were held, sponsored by the T. Buck Suzuki Foundation in cooperation with the West Coast Environmental Law Association, the Georgia Strait Alliance, and the Sierra Legal Defence Fund. A background paper will be available from the BC Ministry of the Environment. [Adapted from *WCEL News*]

Storm-water pollution survey has good news and bad news

Last spring, Jenny Parker and Lynn Hayek, two nine-year-olds from Ottawa, Ontario carried out a storm-water survey for a school project on water pollution. They felt that animal droppings, garbage, oil, and chemicals were being washed into Mooney's Bay, part of the Rideau River system, through storm sewers. This pollution then either increased toxicity levels of the water or decreased the amount of oxygen available for animals through eutrophication.

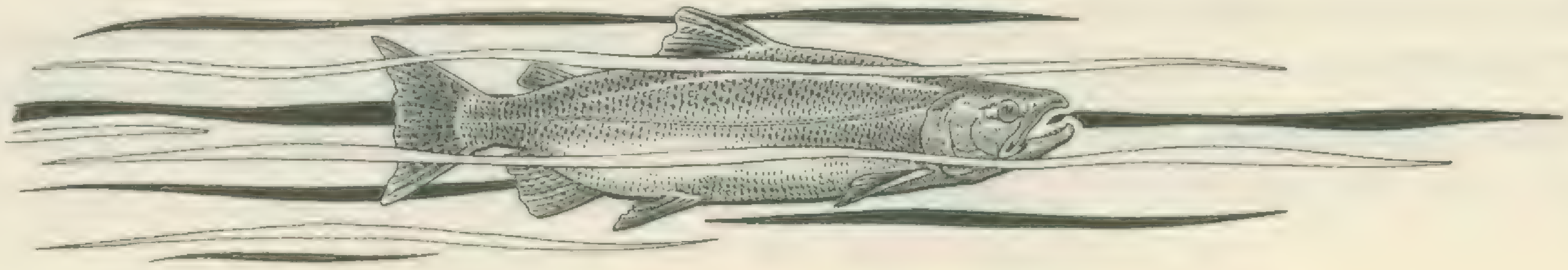
To find out if they were right, the two girls surveyed the 40 houses that drain into storm-sewer pipe 57, which drains into Mooney's Bay. Their questions and findings were as follows:

Do you use chemicals on your lawn or garden? (Bad news! 21 out of 40 said yes.)

Do you ever pour stuff like old paint or oil down the storm sewer? (Good news! Only 1 out of 40 said yes.)

Do you have a cat or a dog? Do you stoop and scoop? (Good news! 20 out of 40 have pets; only 2 don't stoop and scoop.)

Global biodiversity congratulates Jenny and Lynn for their good citizenship and environmental concern. [D.E.M.]



LEAD Canada now accepting applications

LEAD Canada, or Leadership for Environment and Development, is a two-year training program targeted at Canadians who are at the mid-career level. The program provides training in leadership skills and an opportunity to explore a variety of substantive issues related to the environment and economy. Over the course of the program participants meet at two national and three international training sessions. The international sessions are a unique opportunity to meet and work with professionals from around the world and provide an entry for Canadians to a powerful global network.

LEAD Canada is part of an international program begun by the Rockefeller Foundation and is administered in Canada by the National Round Table on the Environment and the Economy (NRTEE). The next training cycle begins in June 1997, and applications are currently being accepted. Space is limited. For further information or application forms, please contact: LEAD Canada, c/o NRTEE, 1 Nicholas St., Suite 1500, Ottawa, Ontario K1N 7B7, Tel: (613) 992-7189, Fax: (613) 992-7385, E-mail: <lead@nrtee-trnee.ca>, web site: <http://www.nrtee-trnee.ca>.

Discontinuation of the ATBI

Thanks to Dr. Robert Anderson for forwarding *Global biodiversity* a copy of a letter sent on 8 November 1996 to those who have been involved in the All Taxa Biodiversity Inventory (ATBI) of Costa Rica's Area de Conservación Guanacaste (ACG) by the Instituto Nacional de Biodiversidad (INBio), the Sistema Nacional de Areas de Conservación (SINAC), and the Guanacaste Conservación Area (ACG):

> We have decided today to permanently discontinue the ATBI of the Area de Conservación Guanacaste.
>
> The concept of biodiversity development is alive and thriving in Costa Rica. The concept of conducting an ATBI of a large complex biodiverse wildland, so as to set up biodiversity for non-damaging sustainable use, is attractive and feasible on many counts to many people for many reasons. However, we have come to the conclusion that the necessary political, economic and institutional conditions to actually conduct an ATBI of the ACG are not present, either nationally or internationally. It is not the right combination of the time, place and circumstances in the history of tropical biodiversity development to carry out this initiative. An ATBI may well appear somewhere in the future but it would be non-productive to continue to try to force it to appear here now.
>
> All of you have contributed in many ways to these four years of ATBI planning and trial. Your efforts were not wasted, neither locally, nationally nor globally. The planning and trials of the ATBI have generated many ideas, initiatives and actual projects that will be developed with currently identified donors and resources. It is the intention of all of the Costa Rican biodiversity development process to continue to nurture as many as possible of these specific actions through INBio, the ACG and SINAC. We do not wish to waste the diverse and dedicated resources that have been assembled for what was anticipated for the ATBI. However, it is likewise clear that we all face a world of limited human and financial resources.
>
> INBio continues its mission of national biodiversity development in full force. The ACG comes out of this experience deeply committed to ensuring the survival of its 235,000 species and its mosaic of habitats through their biodiversity development. The government as a whole continues with its vigorous restructuring of the Ministry of the Environment and Energy, with special emphasis on SINAC and on taking Costa Rica into sustainable development.
>
> We will be contacting you individually over the next several months to discuss ways and how you may be willing continue to lend your energy and knowledge to Costa Rica's struggle for national sustainable development. You have been most important in helping us to get to where we are. Please accept our very deepest thanks for not only what you have given directly to this project, but for having lived this most intense and intriguing experiment with us.

Signed: Raúl Solórzano, Director, SINAC; Sigifredo Marín, Director, ACG; Róger Blanco, ACG; Daniel Janzen, Biologist; Winnie Hallwachs, Biologist; Rodrigo Gámez, Director, INBio; Alfio Piva, Director Adjunto, INBio; Carlos Mario Rodríguez, Coordinator, Inventory Division, INBio

Readers may be interested to know that the above-mentioned terrestrial ATBI gave birth to a marine ATBI process following a workshop in 1995 by the Center for Marine Conservation in Washington DC.

Petawawa National Forestry Institute closes

As a result of federal cutbacks announced in February 1995, the Petawawa National Forestry Institute (PNFI) of the Canadian Forestry Service (CFS) closed early in 1997. Most of the 132 staff were laid off in late 1995. Fortunately, many of the science initiatives have been relocated to the five remaining CFS laboratories located in Victoria, British Columbia; Edmonton, Alberta; Sault Ste. Marie, Ontario; Quebec City, Quebec; and Fredericton, New Brunswick.

The closure of PNFI represents a significant loss to long-term forest ecological research in Canada. The Petawawa Research Forest (PRF) covers an area of about 100 km^2 and contains the most extensive and oldest *ex situ* collection of forest genetic resources in Canada. The material in this collection has taken 50 years to establish and thus, its loss represents 50 years of Canadian investment in forest genetics research and 75 years of investment in silvicultural field experiments. Many of these experiments continue to yield important information.

Forest research is unique in the long time-frame required to complete many field-based studies. The closure of the PNFI is, thus, a major setback to the long-term research needed to develop information and criteria for developing sustainable forestry practices. The closure of both Institute and Forest makes it difficult to defend Canada's stated desire to play a leadership role in conserving biodiversity and in developing sustainable forestry practices.

Environment Canada and State of Sao Paulo undertake watershed project

With its great urban and industrial concentration, Sao Paulo, Brazil faces enormous water-quality challenges. This joint project will aim to improve water-quality management in the state by drawing on a range of relevant Canadian and private-sector capacities, such as informatics tools, regulatory approaches, and specific wastewater treatment technology. Environment Canada will coordinate the Canadian project team, and the Brazilian partner will coordinate a consortium of agencies responsible for environmental preservation and the management of Sao Paulo's water and sewer systems. If successful, the model could be applied to 22 additional watersheds in the state of Sao Paulo. CIDA (the Canadian International Development Agency) will contribute $3 million to support this initiative, through the Canada-Brazil Technology Fund. [Environment Canada news release, 24 November 1996]

New citizen's handbook on wetlands available now

Over the past 20 years, people in British Columbia have become aware of the environmental crises occurring in forests and to fish populations. Meanwhile, the plight of wetlands, those vitally important habitats for fish, birds, amphibians, insects, and the billions of invertebrates and microorganisms that form the basis of the global food chain, have been pushed to the background, not only in the media, but in terms of legislative protection. The result is that British Columbia does not have a clear and complete set of provincial wetland laws or a written wetlands policy. The legislation that does exist is inadequate, and often not enforced.

Protecting British Columbia's Wetlands: A Citizens Guide is a first step in overcoming this lack of protection. This pocket guide is a collaboration of the West Coast Environmental Law Research Foundation and the BC Wetlands Network. It introduces wetlands science, and describes the current legislative framework to protect wetlands. It also proposes changes to that framework, and discusses the legal tools needed to protect wetlands. The Guide includes case studies of legal challenges to protect wetlands in BC and excerpts from the North Vancouver Environmental Protection and Preservation Bylaw.

Copies can be ordered from the West Coast Environmental Law Association for $10 for the first copy, and $5 for each additional copy ordered at the same time (including shipping and handling). Contact: West Coast Environmental Law Association, 1001-207 West Hastings Street, Vancouver, B.C. , V6B 1H7, Tel: (604) 684-7378, Fax: (604) 684-1312, E-mail: <admin@wcel.org>. [Adapted from *WCEL News*]

We've moved!

In December 1996, Canadian Museum of Nature researchers and collections specialists made the final move into a brand new, state-of-the-art building at 1740 Pink Road in Aylmer, Quebec. The building has been specially designed to safeguard the Museum's more than 10 million natural history specimens. The mailing address remains the same, but if you're planning to visit a Museum colleague, phone ahead for directions.

Cyberdiversity:

Biodiversity and the Internet

New biodiversity education site

The Bio-Blitz Biodiversity Exploration & Education site can be reached at:

<http://www.im.nbs.gov/blitz.html>.

World Bank's Global Environment Facility on line

Through the web site of the World Bank's Global Environment Facility (GEF) you can access a host of information. Under "What's New," I found Council Meetings/Documents; Intersessional Work Program; the GEF Project Portfolio; and the NGO Information Kiosk. Under "Introduction to the GEF," I found Council Members, Alternates and Constituencies; Implementing Agencies; and Contact Information. Under "Questions and Answers" (English/Spanish/French), I found States Participating in GEF and Country Bulletins, GEF Gateway to Related Sites, and GEF CEO and Secretariat. The URL is: <http://www.worldbank.org/html/gef>.

Écoroute de l'information

Écoroute de l'information <http://ecoroute.uqcn.qc.ca> was launched by the Union québécoise pour la conservation de la nature (UQCN) in Montreal at the IUCN World Conservation Congress. The site is in French, but may include brief summaries and commercial material in English in the future, depending on demand. The site presents material that focuses on Quebec expertise, products, and services for the francophone public and markets. It creates a common meeting ground and forum for a variety of people, such as entrepreneurs, health professionals, ENGO members, academics, government workers, and the general public, to meet and exchange ideas.

The site consists of eight main sections: Exchanges, Environment in Quebec, Ecotourism and Adventures, Quebec's Environmental Industry, Environmental Groups, Institutional Sector, Environmental Education, and The "Green" Consumer. UQCN is interested in working in cooperation with others already on the Internet and developing partnerships with any who favour electronically disseminating environmental information. For more information, please contact Romain Coté-Martin Savard, Écoroute de l'information, UQCN, 690 Grande-Allée Est, 4th floor, Québec, Quebec G1R 2K5, Tel: (418) 648-2104, Fax: (418) 648-0991, E-mail: <ecoroute@uqcn.qc.ca>.

School outreach program: Can you help?

The GreenLife Society – North American Chapter (GLSNA) has recently launched a new Net-based educational program for high school students, "Environmental Education Without Frontiers" (EEWF). EEWF uses the Internet to provide education on environmental issues to students, without charge, throughout the world.

The structure of the program is as follows:

Each month, GLSNA selects a specific topic to focus on, e.g., the decline of global biodiversity and its causes, the global warming crisis, ozone depletion and climate change, or desertification. They will then send an electronic "module" on this topic to each of the enrolled schools. This module will include: a description of the problem; suggestions on what students can do to address the problem; and suggestions for further readings. In the future GLSNA hopes to set up avenues for communication between the students in each enrolled school to foster trans-cultural perspectives on these issues, and enhance overall appreciation of other cultures.

GLSNA has launched EEWF primarily because of the paucity of environmental educational resources in many parts of the world. GLSNA recognizes that the Internet necessarily limits what kinds of educational materials can be distributed, and that access to the Internet is extremely limited in many regions, but believes that this program can make at least a small contribution to enhancing the educational experience of students in other parts of the world.

GLSNA is currently seeking volunteers who will help us make the program viable. Our most pressing need is for individuals and organizations that will help us draft the educational modules. If you are interested in assisting us in this, or in helping to coordinate the program, please contact Wil Burns, Director; GreenLife Society – North America; 700 Cragmont Ave.; Berkeley, California 94708 USA; Tel: (510) 558-0620; E-mail: <pcis@igc.apc.org>.

The first module, focusing on the impact of overpopulation on the environment, has recently been posted on the site at: <http://EELINK.umich.edu/greenlife/index.html>.

The Shrew(ist's) Site

This new web site <http://members.vienna.at/shrew> is intended to become a platform for all researchers of *Soricidae* (Insectivora, Mammalia) and wants to promote international cooperation. It contains information on shrews, a bibliography, an inquiry forum, links, shrewists on e-mail, congress announcements and other information. It is still under construction, and input is welcomed. [Dr. Werner Haberl, Hamburgerstr.11, A-1050 Vienna, Austria. E-mail: <shrewbib@sorex.vienna.at>]

EPA Internet Newsbrief

Internet Newsbrief is a weekly service from the EPA Headquarters Library that provides a sampling of new and/or useful Internet resources for EPA staff and other environmental professionals. If you would like to subscribe, please send a message to: <listserve@unixmail.rtpnc.epa.gov>. Leave the subject line blank, or put a period in the subject area. In the body of the message, type <subscribe INTERNETNB-L firstname lastname>. If you have any questions, please contact the Headquarters Library, by e-mail at <library-hq@epamail.epa.gov> or by phone at (202) 260-5921.

Join the *Global biodiversity* forum

We are pleased to announce the launch of a new feature in the *Global biodiversity* section of the Canadian Museum of Nature Web site. We are experimenting with posting an article from a future issue and inviting your comments on the article. The forum will be moderated. Selected comments will be posted on the forum page, and some of these comments will also be published in conjunction with the article.

As you read this, Editor Don McAllister's viewpoint on "The Looming Threat to the Fair Sharing of Benefits" is now posted. We encourage you to read the article, and send us your perspectives. To join the forum, go to <http://www.nature.ca/english/gbfor.htm>.

Also, you may be interested to explore the "Species at Risk in Canada" section of the Museum site. The section provides a backgrounder on Canada's ecozones, a close-up look at the Boreal Shield ecozone, and three species at risk within that ecozone. You can find this section at <http://www.nature.ca/english/atrisk.htm>. And finally, invite any young surfer that you know to open up the gifts that "Beautiful, Bountiful Biodiversity" has to give all of us! <http://www.nature.ca/english/bioopen.htm>.

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Biodiversity meetings

8 APRIL 1997

2nd Annual International Wildlife Law Conference, to be held in Washington DC, USA.

Contact: *Wil Burns, GreenLife Society – North America, 700 Cragmont Ave., Berkeley, CA 94708 USA, Tel/Fax: (510) 558-0620, E-mail: <pcis@igc.apc.org>. Online registration may also be done on GreenLife's Web site: <http://EELINK.umich.edu/greenlife/index.html>*

11 APRIL 1997

3rd International Ocean Pollution Symposium (IOPS), to be held in Ft. Pierce, Florida, USA.

Contact: *Mr. Iver W. Duedall, Organizing Committee Chairman, Fax: (407) 984-8461, E-mail: <iops@fit.edu>, Web site: <http://www.fit.edu/~duedall/iops>*

24–26 APRIL 1997

Annual Meeting of the Association of Systematics Collections (ASC) to be held in Atlanta, Georgia, USA, jointly with the Association of Science Museum Directors (ASMD).

Contact: *ASC, 1725 K Street NW, Suite 601, Washington, D.C. 20006-1401, USA, Tel: (202) 835-9050, Fax: (202) 835-7334, E-mail: <asc@ascoll.org>, Web site: <http://www.ascoll.org/>*

26 APRIL–3 MAY 1997

2nd International Symposium on Environmental Software Systems (ISESS): Tools for Environmental Informatics, to be held in Whistler, British Columbia.

Contact: *Dr. David Swayne, Department of Computing & Information Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1, Fax: (519) 837-0323, E-mail: <dswayne@snowhite.cis.uoguelph.ca>*

27–30 APRIL 1997

International Conference on the Biotechnology of Microbial Products, to be held in Williamsburg, Virginia, USA.

Contact: *Society for Industrial Microbiology, 3929 Old Lee Hwy, Suite 92A, Fairfax, Virginia, USA 22030–2421, Tel: (703) 691-3357*

10–14 MAY 1997

Origins of Agriculture and Domestication of Crops in the Near-East, to be held in Aleppo, Syria.

Contact: *Dr. Ardeshir B. Damania, 18–20 Cawasji Patel Street, Jeevan Jyot, II Floor, Fort Bombay 400 001, India, Tel: 91 22 283 2920, Fax: c/o B. Sorabji 91 22 387 65 26*

12–15 MAY 1997

Model Forest Network Symposium, People Growing with Forests, Forum '97 to be held in Winnipeg, Manitoba.

Contact: *Manitoba Model Forest, PO Box 10, Pine Falls, Manitoba R0E 1M0, Tel: (204) 367-5232, Fax: (204) 367-8897, E-mail: <gkynman@cancom.net>*

25–28 MAY 1997

The 8th Global Warming International Conference and Expo to be held in New York, New York, USA.

Contact: *Conference fax hotline (24 hours a day): (630) 910-1561.*

26-30 MAY 1997

Consultative Group on International Agricultural Research (CGIAR) Mid-Term Meting, to be held in Cairo, Egypt.

Contact: *CGIAR, 1818 H St. NW Washington, DC 20433 USA, Tel: (202) 473-8951, Fax: (202) 473-8110, E-mail:<cgiar@cgnet.com>*

6–9 JUNE 1997

Annual Meeting of the Society for Conservation Biology (SCB): 1st Symposium on Marine Conservation Biology, to be held in Victoria, British Columbia.

Contact: *Dr. David Duffus, Program Chair, Department of Geography, University of Victoria, Box 3050, Victoria BC, Canada, V8W 3P5, Tel: (604)721-7344, Fax: (604)721-6216, E-mail: <SCBprog@office.geog.uvic. ca>*

18–20 JUNE 1997

4th International Conference on Water Pollution Modelling, Measuring, and Prediction, to be held in Bled, Slovenia.

Contact: *L. Kerr, Water Pollution 97 Conference Secretariat, Wessex, Inst. of Technology, Ashurst Lodge, Ashurst, Southampton SO407AA, UK, Tel: 44-1703-293-223, Fax: 44-1703-292-853, E-mail: <wit@wessex.witcmi.ac.uk>, Web site: <http://www.witcmi.ac.uk>*

22–27 JUNE 1997
63rd Annual Meeting of The American Malacological Union, to be held in Santa Barbara, California, USA.

Contact: *Eugene V. Coan, President, AMU, 891 San Jude Avenue, Palo Alto,California USA 94306-2640, Tel: (415) 977-5681, Fax: (415) 977-5799, E-mail: <gene.coan@sierraclub.org>*

25–28 JUNE 1997
3rd International Interdisciplinary Conference on the Environment, to be held in Cambridge, Massachusetts, USA.

Contact: *Demetri Kantarelis or Kevin L. Hickey, IEA/Kantarelis-Hickey, Assumption College, 500 Salisbury Street, Worcester, Massachusetts USA 01615, Tel: (508) 767-7557 or (508)767-7296, Fax: (508)799-4502, E-mail: <kantar@eve.assumption.edu>, Web site: <http://www.assumption.edu/ html/academic/conf/iicecall.html>*

25 JUNE–2 JULY 1997
Annual Meeting of the American Society of Ichthyologists and Herpetologists, to be held at University of Washington, Seattle, Washington, USA.

Contact: *ASIH-1997, University of Washington Extension Registration Services, 5001 25th Ave. NE, Seattle, WA, USA 98105-4190, Tel: (206) 543-2320, Fax: (206) 685-9359, Web site: <http://artedi.fish.washington.edu/asih/asih97.htm>*

21–25 JULY 1997
10th International Congress of Protozoology, to be held in Sydney, Australia.

Contact: *David Patterson, School of Biological Sciences, University of Sydney, NSW, Australia, 2006, E-mail: <djp@bio.usyd.edu.au>*

15–17 SEPTEMBER 1997
Canadian Council on Ecological Areas National Conference, Protected Areas and the Bottom Line, to be held in Fredericton, New Brunswick.
Contact: CCEA 97 Conference, Natural Resources and Energy, PO Box 6000, Fredericton, NB, E3B 5H1, Tel: (506) 453-2730, Fax: (506) 453-6630, E-mail: <ccea97@gov.nb.ca, Web site: <http://www.gov.nb.ca/dnre/ccae.htm>

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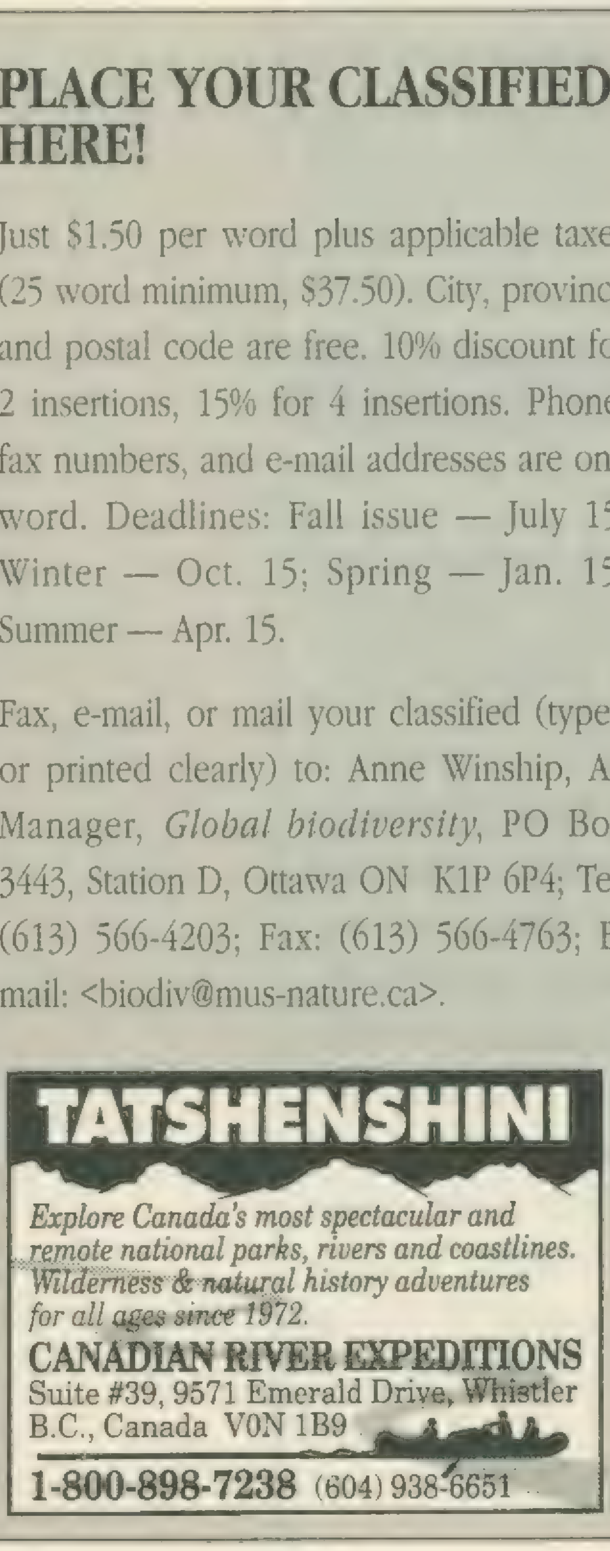
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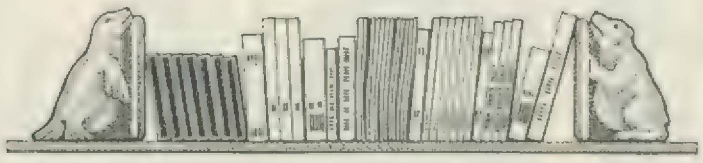


Book and periodical niche

Human impact on the Earth

By William B. Meyer. 1996. Cambridge University Press, New York, NY. Paper, ISBN 0-521-55847-6. US $24.95.

How many people can the Earth support?

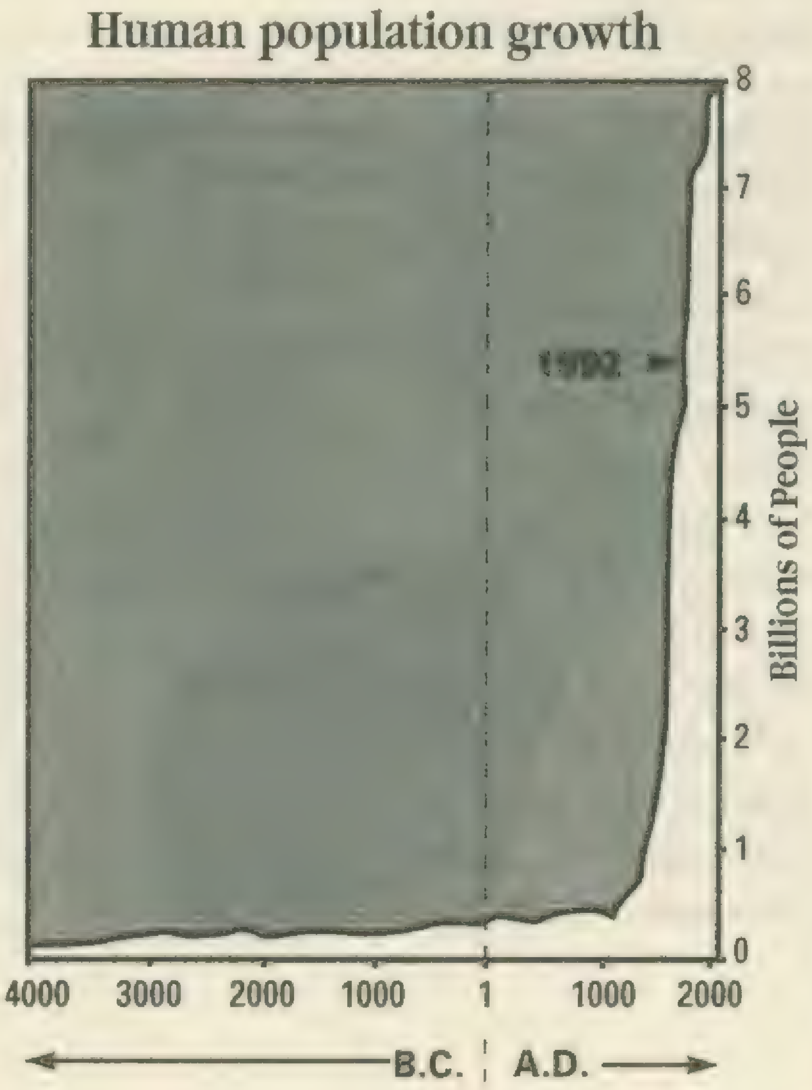
By Joel B. Cohen. 1995. W.W. Norton & Co. 416 pp. Cloth, ISBN 0-393-03862-9, US $27.50.

These are two very different books that, in some ways, demonstrate the long-standing tension in environmental studies. Meyer's volume looks at what humans have done to the biosphere. Cohen's asks what can it do for us. While Meyer's study critically engages "conservationist" and "preservationist" discourses, Cohen's is committed to the anthropocentric perspective of the better management of Earth as a home for humankind. Both are comprehensive and imaginative in their approach.

Meyer should be congratulated for making accessible the work of the 100 scientists who gathered together in 1987 to discuss the theme, "The Earth as Transformed by Human Action." It resulted in a multi-authored *magnum opus* of that title (1990) that analyzed humankind's impact on the biosphere over the last three centuries. In this volume, Meyer updates, amplifies, and interprets that earlier work in a comprehensive set of chapter-length reviews of several environmental sectors: population; the land; biota; water; chemical flows; and oceans, atmosphere, and climate.

Meyer first presents an overview of the long-term transformation of the Earth by human action and identifies several diagnostic features: the present scale and rate of human change is unprecedented — it now affects principal flows of matter and energy; the interactions and feedbacks resulting from these changes are getting more complex; continued increases in population and standards of living promise even greater changes. These are then qualified: many natural processes dwarf human inputs; much of the Earth has been little modified; some impacts have been diminished; not all impacts should be labelled "damage" or "degradation"; much human impact predates the "modern" era; many past fears have proven to be unfounded.

For this reader, at least, Meyer's attempt to seek a balanced assessment of the essential character of environmental change strays too far into the realm of the power of "natural" change, the role of "substitution in resource use," and human capability for "technological improvement." Each of these exists. But as Meyer himself demonstrates, human impact, motivated by consumerism and materialism, have transcended mere superficial alterations of the "face" of nature. They are now interfering with the structure of flows of energy and matter in the biosphere. This interference promises major repercussions on the quality of life, human and natural.



It is clear that the rate of human growth is unprecedented. Already we are using 60% of vegetated land for farms, managed forests, and recreation, and the amount of space for all other species is still shrinking.

Human impact, motivated by consumerism and materialism, has transcended mere superficial alterations of the "face" of nature. They are now interfering with the structure of flows of energy and matter in the biosphere.

To be sure, there is evidence of the antiquity of human impacts; long-standing "climax dogma" is being challenged by the advocates of fluctuation and disturbance; some of the past disruptions are being ameliorated by resilient ecosystems and the ingenuity of human technology. But these arguments only serve to detract from pressing problems.

Overall, Meyer seems to straddle the fence between the "Catastrophists" and the "Cornucopians." For him, the lesson of history is the recognition that "flexibility and capacity for coping with the unexpected as the route to a more secure environmental future." For me, it is the overall scale of human exploitation of the biosphere that is traumatic; the evidence of critical pressure points is irrefutable; the need for policies of intervention is long overdue.

Some of these issues are to the fore in Cohen's study *How Many People Can the Earth Support?* His particular focus, however, is the question explicit in his title: the Earth's carrying capacity in the context of the interaction between population, economics, environment, and culture.

His volume is organized in five parts. An introduction defines the problem and the author's approach. Part 2 describes the history of global population growth in terms of accelerating rates of increase, the increasing proportion of older people, increasing consumption of inanimate energy, increasing urbanization, and the "cultural implosion" produced by greater mobility and enhanced communications. Part 3 critically examines several approaches taken by demographers in predicting future populations. Part 4 turns to applied ecology and the concepts of carrying capacity defined in the context of the dynamic interaction between the environment, social, political, and economic systems, and human values, preferences, and ethics. Part 5 closes the study with a survey of approaches to future policies.

If Cohen's style is flamboyant, his scholarship is impeccable. He cannot resist the witty aphorism, but he couches his playfulness in magisterial research and documentation. It is a very readable and professional assessment of population history, scenarios of future population, and estimates of the maximum numbers the Earth can support. But don't turn to it for solutions. As with so many academic studies, it is strong on defining the problems, but short on resolving them.

Each of these books is accompanied by excellent up-to-date bibliographies. They are also well served by clear diagrams and tables. More importantly, they situate their respective assessments of human impacts on ecological processes in the complex realm of social and economic verities.

Brian S. Osborne, Geography Department, Queen's University, Kingston, Ontario

Biodiversity and the law

Edited by William J. Snape III. 1996. Island Press, California. 260 pp. Paperback, ISBN 1-55963-395-6. US $25.00.

Biodiversity and the Law is a collection of essays written by American experts from academia, the legal profession, and government. It is primarily concerned with examining the various legal tools available for protecting biodiversity. *Biodiversity and the Law* is an American book dealing with American laws. However to environmentalists outside the United States, the book provides some powerful and timely insights.

In some ways, the US woke up 20 to 30 years ago to the eroding state of the environment, provoked by Rachel Carson's *Silent Spring* and the rapid demise of the iconic bald eagle. In the late 1960s and early 1970s, environmental concern reached unprecedented levels in the US. Memberships of environmental groups grew into the millions. The US government responded by passing a series of laws intended to provide environmental protection, including the *Endangered Species Act*, the *National Environmental Policy Act*, the *Wilderness Act*, the *Clean Air Act*, the *Clean Water Act*, the *Wild and Scenic Rivers Act*, and the *National Forest Management Act*.

The essays in *Biodiversity and the Law* examine these laws and evaluate their effectiveness. There is also a group of essays dealing with international legal efforts to protect biodiversity. The results are not encouraging: frequently American environmental laws have been rendered impotent by inadequate funding, weak enforcement, and a lack of political will.

It is somewhat disconcerting to think that the Americans have had strong environmental laws on the books for over 20 years, and despite this purportedly potent legal regime, the quality of the American environment, including biodiversity, has significantly declined. Are new laws the answer? Is better enforcement of existing laws the answer? Is a constitutional amendment to protect the environment the answer? *Biodiversity and the Law* reviews these issues and concludes that, in all likelihood, none of these legal mechanisms will single-handedly remedy the biodiversity crisis.

We, as Canadians, are just beginning to awaken to the fact that our vaunted "natural resources" are not infinite. The collapse of the East coast cod fishery shocked a complacent population accustomed to seeing Canada as a vast and inexhaustible cornucopia of wealth. We erroneously assumed that we were better stewards of the land and had no need for laws to protect the environment. Those halcyon days are over. Our governments are rushing to catch up and are endeavouring to learn from the US experience. In 1995 the *Canadian Environmental Assessment Act* was passed. The federal government is developing an *Endangered Species Act*, which received first reading in Parliament on 31 October 1996. If adequately drafted, this new law should provide lifejackets for the most imperiled passengers on the Canadian ark. (*Editor's Note:* As drafted, Bill C-65 would give protection against killing or harming an endangered or threatened species or damaging its habitat. It would also initiate recovery plans for those species. The application of this bill would be limited to about 40% of the species at risk — aquatic and marine species, certain migratory birds, and species on federal lands. For more limitations of the bill, see *Global biodiversity* 6(2): 29–31.)

It is imperative that we build on the American experience, rather than repeat their mistakes. By critiquing the American laws and suggesting directions for the future, *Biodiversity and the Law* offers valuable guidance for Canadian lawmakers, lawyers, and environmentalists. Canadians must find ways of ensuring that provincial and federal governments coordinate their jurisdictional powers to create strong and binding laws.

Ultimately this book raises more questions than it answers. Under the current Canadian legal regime, laws offer scant protection to biodiversity. Some help in the form of endangered species legislation, which has been perhaps the most effective legal tool in the US, appears to be on the way. However, as the American experience all too clearly illustrates, law is only a tool. What we really need to protect biodiversity in Canada is a shift in values towards Aldo Leopold's land ethic, described in *Biodiversity and the Law* as "an ecological morality in which humans see themselves not as conquerors of nature but as partners in our shared land community."

David Boyd, Sierra Legal Defence Fund, Vancouver, BC

Making nature, shaping culture: Plant biodiversity in a global context

By L. Busch, W.B. Lacey, J. Burkhardt, D. Hemken. J. Moraga-Rojel, T. Koponen, and J. de Souza Silva. 1995. University of Nebraska Press, Lincoln, NE. US $ 42.50.

Having started this book intrigued by its title, I was initially disappointed and somewhat incredulous at the first line "Nature is not natural" and, indeed, the entire first chapter (entitled "Constituting nature, manufacturing plants") with its entirely anthropocentric view of nature and biodiversity. "Nature was what human beings made it, for their ends" state the authors, without mentioning alternative views. Given the authors' experience as sociologists, economists, and agricultural scientists, this all too common view of nature as a resource existing only for human benefit is perhaps not surprising. Their philosophical discussion of nature, neither strongly supported nor particularly cogent, would have been easier to digest if it had been restricted to crop plants. If you can struggle through (or skip) the first chapter, the remainder of the book is worth reading. The book deals with one small, albeit important, aspect of plant diversity, that of crop diversity and conservation.

The second chapter describes the current trend towards increasing genetic uniformity and vulnerability of crops, and hence the need for organized crop germplasm conservation. The development of an international system for germplasm conservation, "a loosely coordinated, often politicized, network," is outlined. The authors view the international debate as a "competition-cooperation paradox." Crop germplasm is an unusual commodity in that it is dynamic and continually undergoing "improvement" through breeding and, more recently, biotechnology.

A detailed historical account of crop diversity and germplasm conservation in the United States leading up to the current situation is presented in Part 2. Beginning with the first colonialists and their use of both indigenous and European crops, the book goes on to describe the government's commitment to "scientific agriculture" and the commercialization of seed production. The role of plant breeder and germplasm conservator has been almost entirely transferred from farmer to institution over the last century. The result is a widespread trend towards decreasing crop diversity, a central theme of the book. A detailed overview is given of the current National Plant Germplasm System, which focuses almost exclusively on crop plants, and the many small grassroots organizations involved with crop breeding and conservation.

The next section attempts to provide an international perspective to germplasm conservation and to show how different methods are culturally based. The history and current status of crop diversity and conservation in France, Brazil, and Chile is outlined, emphasizing differences with the US system. Reasons for conserving germplasm in France include national heritage and responsibility to the tropics in addition to future use which is the primary reason in the US. Germplasm conservation here involves "nontraditional clients" such as ethnobotanists, amateurs, taxonomists, environmentalists and includes a much greater diversity of plants (i.e., not only crop plants). In Brazil only the government's role in crop breeding and conservation is discussed, including the recent emphasis on biotechnology and the creation of genetic reserves; the role of subsistence farmers in maintaining local land races is curiously not even mentioned. Chile is apparently included since it represents a centre of crop diversity (isn't Brazil?). The reader is left wondering about crop diversity and conservation in the rest of the world, far more culturally diverse than the nations with predominantly European-based cultures presented here.

The important issue of access to plant genetic resources and intellectual property rights is discussed in the last section. Commercialization of seed production has led to restricted access, through hybrid seed (which produces an abundant harvest, but poor quality seed), plant protection acts, and patents. The current germplasm conservation system is driven primarily by short term economic gain. The authors recognize that conservation of crop diversity requires a longer term vision than this current utilitarian approach. However, they also comment that "as long as our culture is pitted against nature rather than a part of it, no amount of financial resources and scientific expertise is likely to reverse the trend toward reduced diversity." If the authors really believe in this, they will need to revise their anthropocentric view of nature presented in the first chapter.

This book is recommended for those interested in crop diversity and germplasm conservation. It is an excellent resource on the history, current status, politics, and economics of germplasm conservation. However, before writing another book purportedly about "plant biodiversity in a global context," the authors should perhaps wander out of their cornfields into a deciduous forest, Araucaria forest, alpine meadow, sphagnum bog, or one of the many tropical forests, or at least next time omit the subtitle.

Lynn J. Gillespie, Research Scientist, Canadian Museum of Nature

Grassland: The history, biology, politics and promise of the American prairie

By Richard Manning. Viking Penguin, New York, NY, 10014-3657. Cloth. ISBN 0-670-85342-9. 320 pp. US $23.95.

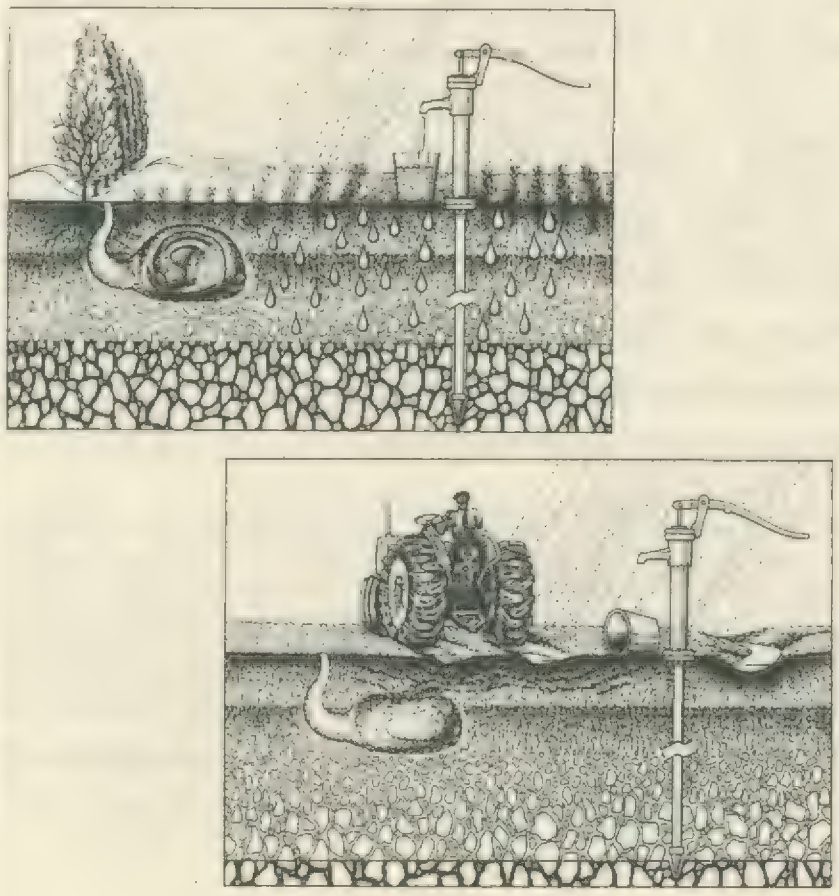
Anyone who has driven through the rolling grasslands of Montana ranch country might be excused for thinking that, aside from the highway and fences, the land is much the way the buffalo left it. Well, looks can be deceiving. Cattle grazing on prairie sites can reduce the number of plant species from 250 to 40. Farming can take that number down to one. Man's exploitation and alteration of the prairie environment is the subject of Richard Manning's *Grassland: The History, Biology, Politics and Promise of the American Prairie.*

As the subtitle suggests, Manning meanders literally and figuratively over the western landscape covering history, biology, literature, and politics as he argues that we have created a way of life that is out of synchrony with the natural rhythms of the great plains. Fifty million bison were replaced with a ranch culture that supports 45 million cattle. A sea of wild grasses has been relegated to postage-stamp size remnants by the plow and an invasion of exotic species. "Undeveloped" prairie, with 48 kilometres of root and rootlets per square metre, is adapted to cyclical drought cycles of the American west. Modern agribusiness monoculture is not as well adapted.

Part travelogue, Manning's work is infused with a deep respect for people who have lived their lives on the land. He finds hope with bison ranchers and community botanists who are restoring lost grasslands. As Manning sees it, the promise of the American prairie lies with reconnecting man's endeavours to the biorhythms of the plains. In the author's view, our first loyalty should be to grass.

While it is hard to imagine a return to the open plains, Manning's message is an important one and *Grassland* is full of interesting stories and insights gleaned from our western experience. The issue of living in harmony with the natural systems we depend on is relevant not simply to the American west, but the world at large.

Doug Mander, Toronto, Ontario



On the prairies, a sea of wild grasses has been relegated to postage-stamp size remnants by the plow and an invasion of exotic species. Modern agribusiness techniques are not well adapted to the cyclical droughts of the West.

Defending the land of the jaguar: A history of conservation in Mexico

By Lane Simonian. University of Texas Press Austin, Première édition, 1995, 326 pp. ISBN 0-292-77690-X.

The author draws a portrait of the history of conservation in Mexico, from Pre-hispanic times to modern environmental organizations. One cannot dissociate conservation from political systems, and there surely exists a direct relationship between the history of politics and the history of conservation in Mexico. That is what the author tries to illustrate.

Did you know that during the 15th century, King Nezahualcóyotl of Mexico built botanical gardens, zoos, and aviaries for his own pleasure? Did you know that President José Portillo created the first biosphere reserve in 1978 — the Azules Mountains Bisphere Reserve? Did you know that President Cárdenas (1934–1940) was the first Mexican president to realize that conservation and development go hand in hand?

The author points out in the preface that, even though some biological resources must be used to benefit the economy, he is convinced that development can be sustainable and not abuse the environment, as it is the case in Mexico and many other parts of the world.

This book will help us understand the history of conservation in Mexico and why Mexicans expend so much energy to protect the environment. It is a very useful tool that will help everyone working in the field of biodiversity conservation to understand the current situation.

Jean Lauriault, Environmental Specialist, Canadian Museum of Nature

Earth in mind: On education, environment and the human prospect

By David W. Orr. 1994. Island Press. Paper. 224 pp, ISBN 1-55963-259-X. US $29.95.

What is the role of education in the current global context? Through a series of thought-provoking essays, David Orr paints a graphic picture of a planet in crisis and the myths that fuel its destruction. Drawing upon historical and modern examples, he illustrates the "problem" of an educational ideology that values technology over conscience and an American society that fails to account for the perils of an exploitative relationship with the environment. *Earth in Mind* calls for an educational "perestroika"; a complete re-thinking of the process and substance of education on all levels.

The strength of the book comes through the author's ability to identify and elaborate on those principles on which education for a sustainable society *should* be based. Each essay provides the reader with a well-synthesized perspective on a dominant theme in the sustainable development debate. Generous use of excerpts from authorities working in economics, ecology, world trade, politics, and a variety of other relevant fields firmly grounds Orr's ideas in a contemporary context. In its effort to integrate such a multiplicity of ideas, however, the breadth and depth of examination varies between chapters. For example, the book tends to focus on the impact social issues have on an individual's quality of life rather than examining broader questions of global security, peace, or health.

Although some readers may find the reformist language a distraction, Orr's arguments for "ecological education," as he terms it, are strong and persuasive. The only weakness in Orr's advocacy approach is that he does not counter his arguments with those of the status quo. In the section on economics, for example, Orr describes the failure of neoclassical economics with respect to the environment. By failing to include arguments of those who view neoclassical economics as a positive force for sustainability, the reader is left with a sense that much of the story is missing.

Orr's specific recommendations are aimed at university reform. The scope is generous — ranging from ideas about the integration of disciplines and criteria for tenure, to the physical architecture and operation of university campuses. The recommendations provide interesting examples of how Orr's ideas could be translated into a practical setting and are not limited in their value to the university arena.

Earth in Mind provides a much needed, comprehensive overview of the challenges education must address in the creation of a sustainable society. Its emphasis on core principles, values, and ethics is a welcome addition to the content-driven material commonly found in the ecological education and sustainable development literature. The text is well organized into three clear sections and the short essay format makes it an excellent quick reference. In *Earth on Mind* Orr has woven a complex range of topics and perspectives into a single, coherent vision and illuminated a timely and controversial debate.

Elin Kelsey, an associate of LEAD Canada, a program of the National Round Table on the Environment and the Economy

The sixth extinction: Patterns of life and the future of mankind

By Richard Leakey and Roger Lewin. 1995. Doubleday & Co. Cloth, ISBN 0-385-42497-3. 224 pp. US $24.95

Sixty-five million years ago, dinosaurs vanished in a geological instant. Are we in the midst of a similar biological catastrophe? Moreover, are we responsible? Well, the Earth has not been hit by a giant meteor recently, but human exploitation of nature may be creating a mass extinction of comparable proportions. That is the argument made persuasively in *The Sixth Extinction, Patterns of Life and the Future of Mankind.* Renowned anthropologist Richard Leakey and veteran science writer Roger Lewin team up to deliver an urgent plea for protection of biodiversity.

While Leakey and Lewin are not breaking new ground here (readers familiar with works by David Raup, Peter Ward, or Edward Wilson will recognize much of the territory), they do deliver a highly readable account of the history of life on Earth that is informed by recent advances in thinking about evolutionary history and ecosystem management.

Over the years, the view of evolution as a steady process toward ever greater diversity has been altered by the realization that life's history is punctuated by sudden mass extinctions and subsequent flurries of speciation. While our understanding of the causes of these extinctions remains somewhat theoretical (climate change, meteor impact), the implications for evolutionary history are profound. Survival through periods of biological crisis may depend more on good luck than on adaptive advantages. Humankind, therefore, is not an inevitable evolutionary champion, but the ancestor of creatures fortunate enough to survive the great biological catastrophes of our past.

Today species loss is driven primarily by habitat destruction, especially in the tropics, where clear cutting and other forms of development are almost certainly eliminating thousands of undiscovered life forms. Leakey and Lewin argue that the current rates of extinction, in geological time, are as sudden and severe as the five greatest extinctions of our past. This habitat loss is eliminating species and biological systems with enormous economic potential. Also, because more diverse systems tend to be ecologically healthier, the loss is also reducing the overall health of the planet. For the authors, humans benefit from biodiversity and have a moral obligation to maintain as many species as possible.

And preserving biodiversity is no easy task. Even the migration of primitive humans into North America may have driven several species, like mammoths and giant sloths, into extinction. Moreover, natural systems, with or without humans, are dynamic and change regularly. Leakey and Lewin make it clear that the static view of a stable "balance of nature" is misleading, and this perception makes managing ecosystems difficult. Drawing on his experience with elephants, Leakey suggests that we should let natural systems run their course, as best we can, and accept a certain amount of change as inevitable in healthy environments.

Leakey and Lewin succeed in delivering an accessible argument that identifies one of our planet's most pressing problems. If we cannot rethink our attitudes toward the natural world, we risk losing the bounty of millions of years of evolutionary creation: in Darwin's words, "endless forms most beautiful," the diversity of life.

Doug Mander, Toronto, Ontario

CALL FOR CANADIAN BIODIVERSITY INFORMATION

The United Nations Convention on Biological Diversity calls for the creation of an information clearing-house to facilitate the exchange of biodiversity-related information and to promote technical and scientific co-operation. Governments, organisations, and indigenous peoples around the world are now working in partnership to develop this "Clearing-House Mechanism." The Biodiversity Convention Office of Environment Canada is facilitating the development of a Canadian component of this global network. The goals of this network - which will include a Canadian Web site - are to;

- Communicate Canadian plans, actions and progress to conserve and sustainably use biodiversity;
- Contribute to heightened awareness and more integrated decision-making by enhancing understanding of the relevance of biodiversity issues.
- Facilitate the transfer of Canadian environmental products, services and other technologies;
- Facilitate communication with biological/ ecological information and data sources;

If you or your organisation have biodiversity information related to any of the above goals that you would like to see made accessible on the Web, please contact the Biodiversity Convention Office at; Place Vincent Massey, 351 St. Joseph Blvd., Hull, Quebec, K1A 0H3. Tel: (819) 953-6252; Fax: (819) 953-1765; e-mail: bcoint@cpits.am.doe.ca

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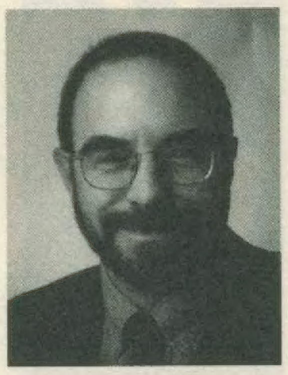
Pierre Dansereau, the barefoot ecologist



Professor Dansereau belongs to the breed of builders. Recognized as the father of ecology in Québec, he has devoted his successful career to the development of this basic science. The first synthesis of his research, titled *Biogeography: An Ecological Perspective*, published in 1957, revolutionized our vision of ecology by offering a new comprehensive view of environmental sciences. The 14 honorary doctorates and the numerous decorations that crown his work confirm the scientific excellence of his research.

A keen promoter of the multidisciplinary approach, Pierre Dansereau is an expert at lateral thinking, knowing better than anybody else where to establish links between subjects, geographical locations, and field observations. His work as director of ecological research for the Mirabel airport project near Montreal, Quebec in the early 70s is still a model of decompartmentalization and openness. His expertise covers fields as immense as biosystematics, phytosociology, and land-use management.

Pierre Dansereau is a committed individual. Deeply convinced of the need to integrate human values in every socioeconomic activity, he promotes his ideas whenever he gets an opportunity: to university chairs, to advisory panels, to parliamentary committees, at public hearings, at scientific workshops, in publications, in the media, etc. Rightly named the barefoot ecologist, he left a long time ago the cramped ivory tower of the university setting to implicate himself in the most heated social debates, going to such ends as founding the Jeunes-Canada movement in the early 30s and presiding over the "Rassemblement," an important movement for democratic education around the late 50s. In 1993, he started the Union pour le développement durable, an NGO devoted to sustainable development.

Through his teaching, his publications, and his public actions, Pierre Dansereau actively contributes to scientific development. As early as 1946, he was secretary-general of the Association canadienne-française pour l'avancement des sciences (ACFAS). In the late 70s, he and the late Fernand Séguin assessed the situation of science museums and in 1993, he participated in the Premier Salon de la Science et de la technologie de Montréal. Wherever he goes around the world, Pierre Dansereau is an exemplary ambassador for the scientific community of Quebec and Canada.

Pierre Dansereau is above all a warm man, enamoured of justice and fairness. He understood very early the importance of integrating the notions of sharing and compassion in socioeconomic development models. One day, at a meeting of the Ordre des comptables agréés du Québec, he even dared promote the idea of GNH, or gross national happiness, as an index of sustainable development.

Pierre Dansereau has inspired several generations of scientists and has paved the way to a better understanding of the close links that tie us to our environment. Thanks to him, our vision of the world has become clearer, we have become aware of our interdependence on living things and our faith in the future has grown stronger.

Jacques Prescott
Associate Editor, *Global biodiversity*

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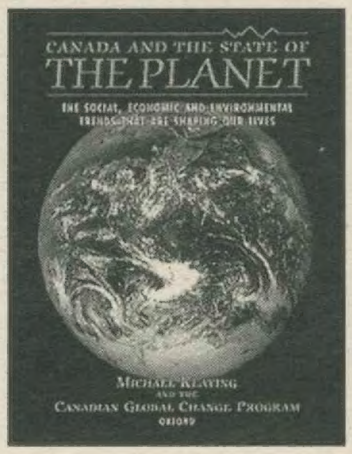
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Ultimately, sustainability will depend on the decisions that citizens make about the lifestyle they wish to pursue and the degree of intimacy they would like to have with nature for themselves and their children.

Maximo Kalaw, President, Earth Council

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